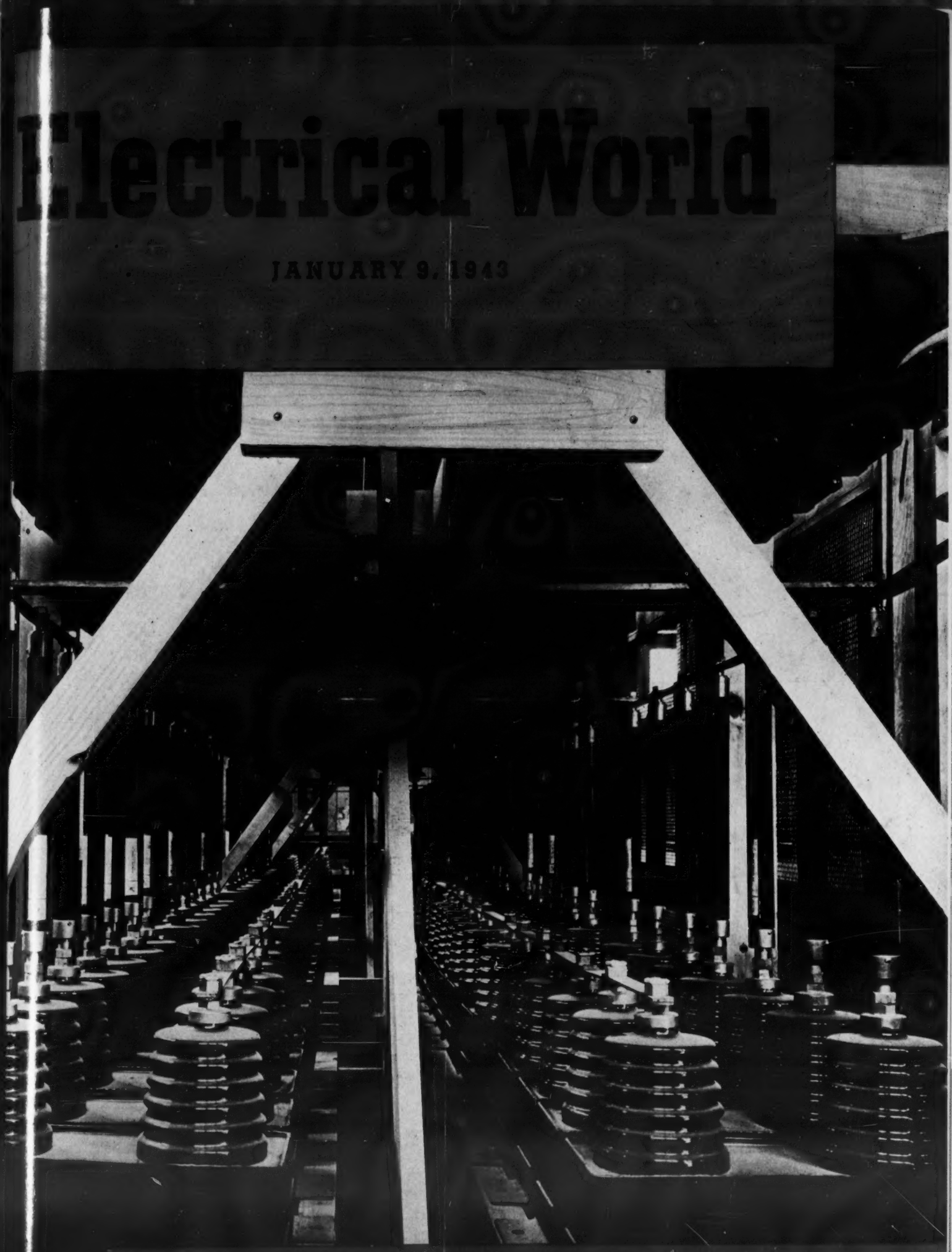
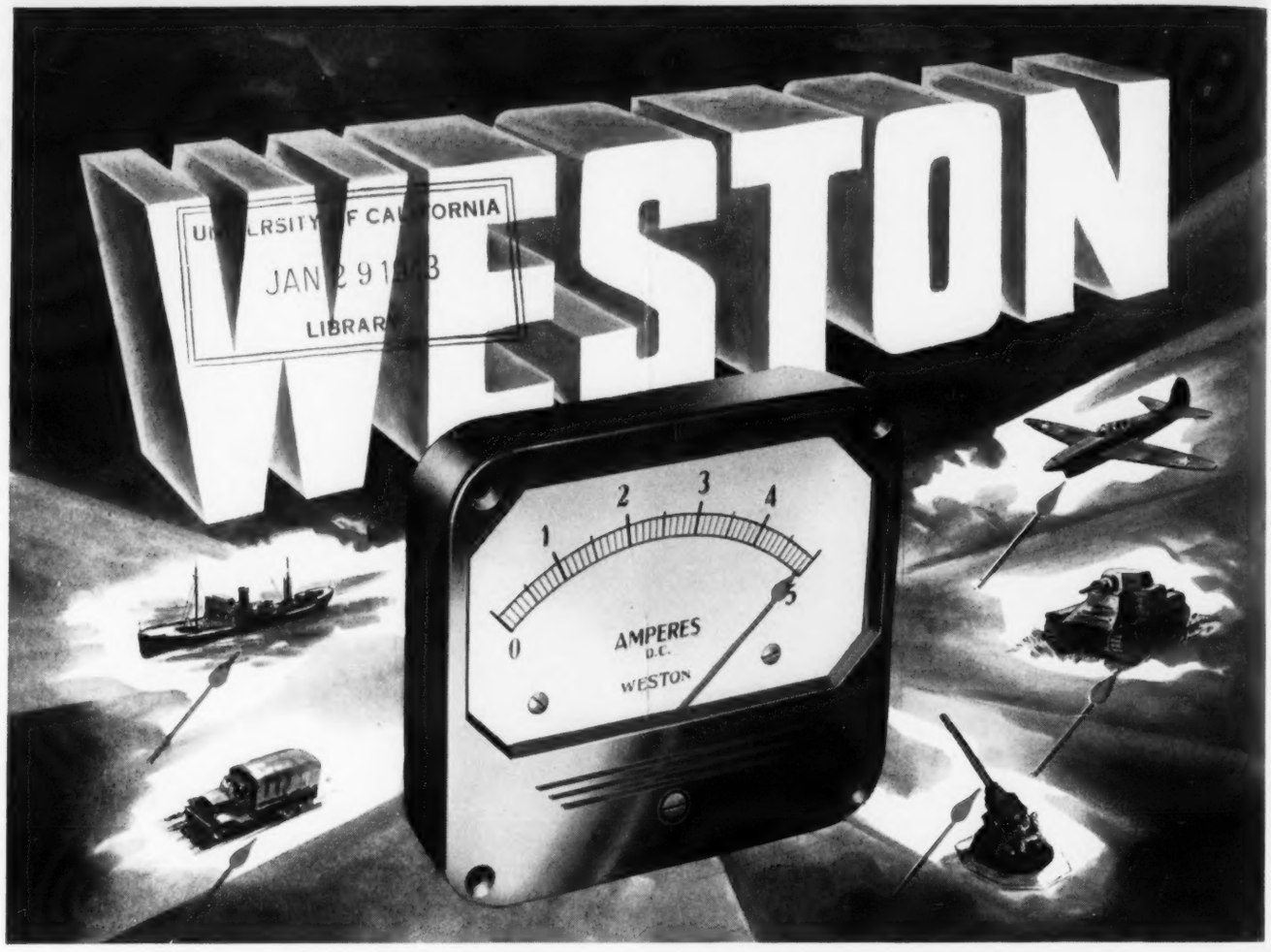
Electrical World

JANUARY 9, 1943



IN WARTIME—CAPACITORS INSTEAD OF ROTATING MACHINES



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Doing the same fundamental Job in 1943 but so much more of it!

ARMY E NAVY

Most manufacturers engaged in war production are working on products foreign to their normal efforts. But it's a different story here at WESTON. We have exactly the same job to do because our job is *so fundamental;* but there's much more, *so much more of it.* For precise measurement is vital to the efficient functioning of equipment in *all* branches of a highly mechanized war machine. And while measurement fundamentals have not changed, the universal preference for instruments the way WESTON builds them *has not changed either.*

So WESTON'S job, as we enter the New Year, still remains the job of striving to keep abreast of the country's unprecedented and critical instrument needs. Production has been increased many fold through expanded and scattered manufacturing facilities. And the curve *continues* upward. But never to the point where we must relinquish, *one bit,* our quality standards — 'else some pilot's safety might be *less* secure . . . a ship's reckoning *less* accurate . . . a critical power plant *less* efficient.

But achieve the production goal *we will;* without jeopardizing quality . . . without interrupting our continuing development program now focused on instruments to help speed victory. And in accomplishing this goal, we will have equipped ourselves to serve *even better* the new and increased instrument needs of the future . . . the needs of American industry at peace. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

FOR OVER 54 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 68 YEARS

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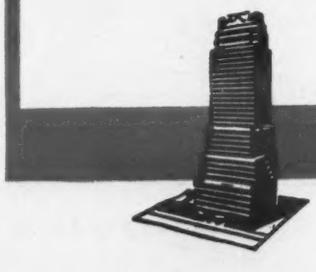

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330 West 42nd Street, New York, N. Y.

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From .....

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To .....

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Signed .....

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Insulation Stability at High Temperature with Metallized Paper Tapes

● *Oven maintained at 100° C. for long time aging tests on power cables, — following the practice developed by one of the major utilities. The samples with ends sealed are placed in the oven. Periodic power factor measurements are checked against initial values. A cable with poor aging characteristics will show a marked increase in power factor under these severe conditions.*

3200

Today's heavy loads on power cables develop temperatures that will hasten deterioration of the insulation unless the proper safeguards are incorporated.

Studies made in the Okonite-Callender Research Laboratories have shown that one of the big factors in the deterioration of oil-impregnated paper-insulated cables is the effect of the metal in contact with the oil. Copper especially has a very pronounced reaction.

Careful analysis proved that these reaction products were concentrated in the first tapes directly over the conductor and also adjacent to the sheath. Our research engineers searched for and found a method of stopping these harmful products (formed by the reaction between copper and oil) from entering the dielectric.

By applying metallized paper tapes under and over the insulation, an efficient absorption medium is provided that also functions as a barrier for holding the harmful products out of the insulation itself.

The results of radial power factor tests (previously published — Bulletin OK-2022) clearly demonstrate these advantages. They have also been confirmed after long time aging tests of the cable itself as indicated below.

	Length A	Length B
Initial Power Factor	0.31%	0.29%
After 1 year at room temperature	0.29%	0.30%
After 1 year at 100° C. in oven	0.34%	0.33%

Tests records show this remarkable stability as checked on two 20-foot lengths of 12 K.V. three-conductor Okonite-Callender cable with metallized paper tape barriers. Practically no change in power factor takes place.

When you are considering paper-insulated cable, it will pay you to have our engineers show you all the facts on this and the many other developments made

Through OKONITE-CALLENDER RESEARCH

THE OKONITE-CALLENDER CABLE CO., INC.

An Affiliate of The Okonite Company

Executive Offices: Passaic, N. J. • Offices in principal cities

OKONITE CALLENDER

PAPER INSULATED POWER CABLES

Salvage Your Scrap — Buy U. S. War Bonds

Electroline FIEGE HEAVY-DUTY DEAD-END

FOR COPPER STRAND (300 to 1000 MCM)

Gives You These SIX ADVANTAGES

1 **HIGH PRESSURE**—Metal to metal contact under high pressure gives ultimate electrical and mechanical strength.

2 **STRONGEST TYPE OF DEAD-END** when used with steel, copper, or composite strands.

3 **SOLDERLESS**—No hot metal is needed. No special tools required. Common tools make or unmake the connection.

4 **EASY INSPECTION**—Inspection holes make visual inspection of the joint quick and positive. No guess work. A sound connection is certain.

5 **NO WASTE** of conductor. The connector can be used over and over again. Easily disconnected. Free from corrosion.

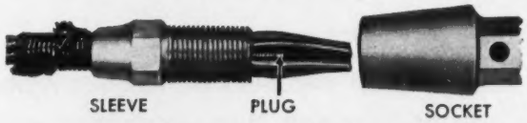
6 **CONDUCTIVITY**—Its resistance is less than an equivalent length of the conductor.

SIMPLE TO INSTALL

ONLY THREE SIMPLE OPERATIONS TO COMPLETE THE DEAD-END CONNECTION

Strand passed through sleeve.

Wires broomed out for insertion of hollow plug.



Plug driven in and wires closed to apply socket.

Socket applied showing twisted wires and completed assembly

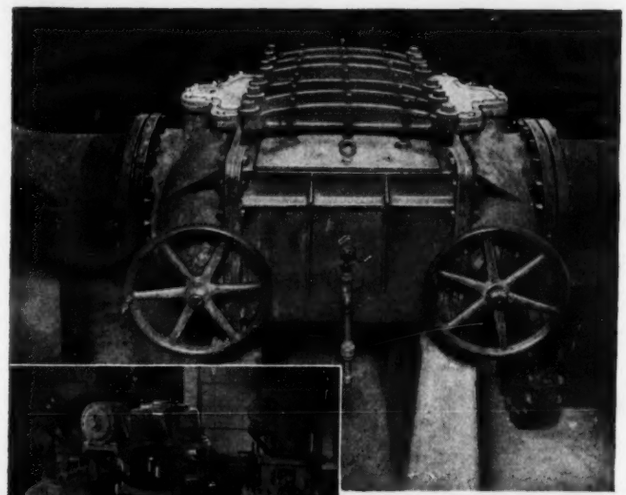
Available in complete range of sizes from 300 MCM to 1000 MCM in Dead-End types as illustrated. Also made in Eye and Straight Coupling types. ***Write today for complete prices and illustrated literature.***

Electroline Company

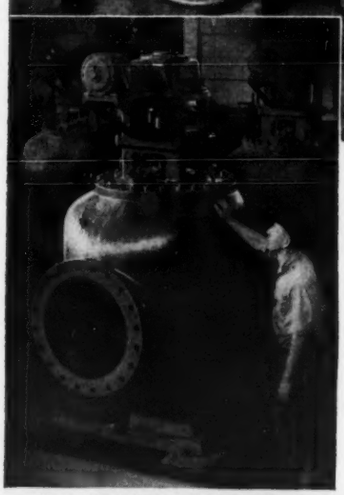
Originators and Patentees of Automatic Line Splices and Dead Ends

4121 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

Stop-light for trouble in water and oil lines



TWIN STRAINERS
This 20" twin strainer is one of 22 Elliott strainers in use in one central station. It protects a raw water suction line. Other Elliott twin and single strainers, in various sizes down to 2", serve in screen wash, chemical feed, lubricating oil, transformer oil, and fuel oil lines. One side of a twin strainer is cleaned while the other side is working.



SELF-CLEANING STRAINERS
do an excellent job of continuously cleaning service water in power plants. A geared motor slowly rotates a sealing box which covers sections of the straining element, allowing them to be back-flushed. Illustrated is a 24" size, part of an order of 16 for a war production plant. Built in sizes 4" to 24".

IN ALMOST ANY POWER STATION, Elliott twin strainers will be found tucked away in inconspicuous spots. No medieval fortress ever enjoyed more positive protection with moat, drawbridge and portcullis, than the water and oil handling equipment whose intake pipe lines are guarded by these unsleeping sentinels.

So many Elliott strainers of various types are in operation today, that we cannot even approximate the vast volume of water, oil and other liquids which they pass. Far less can we approximate the millions of dollars in damage, trouble and delay which they have prevented.

If you have a straining problem, use our wide experience in its solution. Write.

ELLIOTT COMPANY
Accessories Dept., **JEANNETTE, PA.**
DISTRICT OFFICES IN PRINCIPAL CITIES

A-279

Where corrosion MIGHT LOSE A BATTLE OR EVEN A WAR....

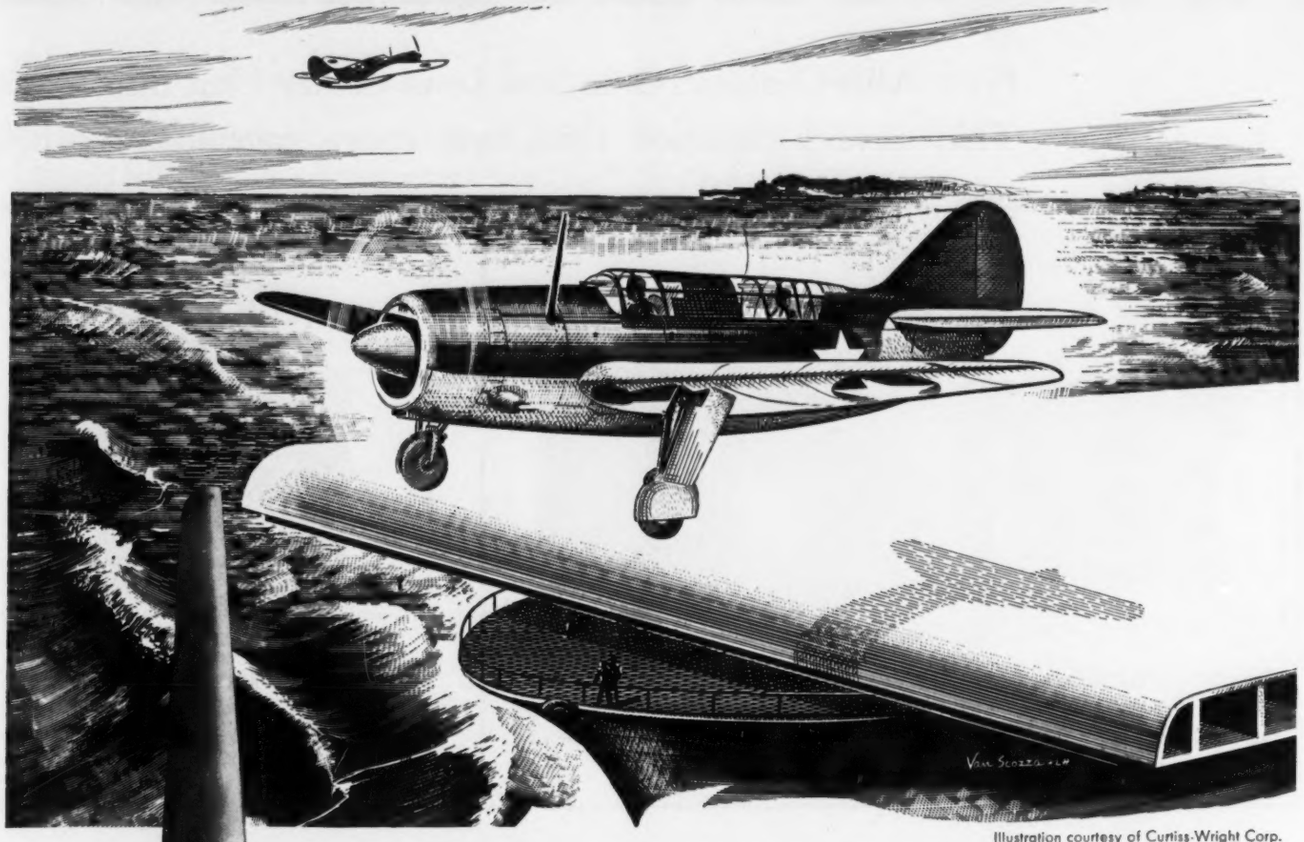


Illustration courtesy of Curtiss-Wright Corp.

CONTINENTAL-DIAMOND *plastics stand guard—*

REPLACING an important quantity of a strategic metal, the DILECTO radio antenna mast illustrated also contributes importantly to our war effort by helping insure uninterrupted radio reception under the most severe and adverse conditions.

The properties of Dilecto* (Grade C) which make this antenna mast stand the gaff are:

1. Great physical strength—
   Tensile Strength 9,500 PSI
   Compressive Strength 38,000 PSI
2. Adaptability of design—Readily molded or machined.
3. High dielectric properties—150 VPM on ⅛" thickness.
4. NON-corrosive.
5. Light weight—Specific gravity 1.36—about half the weight of aluminum, one-seventh that of steel

Again a C-D replacement material has proved to be a BETTERMENT.

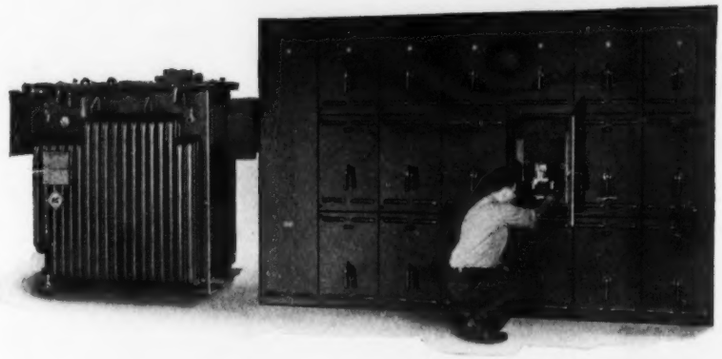
★ Grade C DILECTO is a canvas base laminated plastic, one of many DILECTO Grades. It is a structural material. Other grades excel in dielectric properties; chemical resistance; low dielectric loss. . . . Catalog DO 41 gives complete technical data on all grades. Send for a copy.

Continental-Diamond FIBRE COMPANY

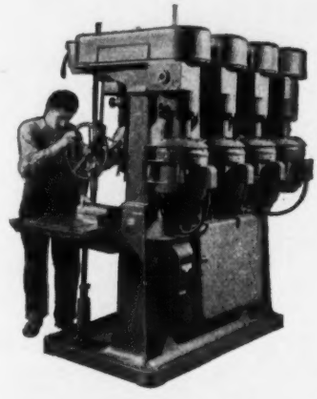
Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Standardized

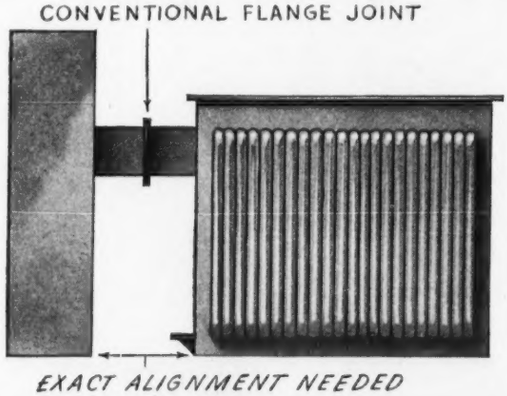
New Allis-Chalmers Standard Load Center Unit Substations
They save installation time, save space, save losses... help

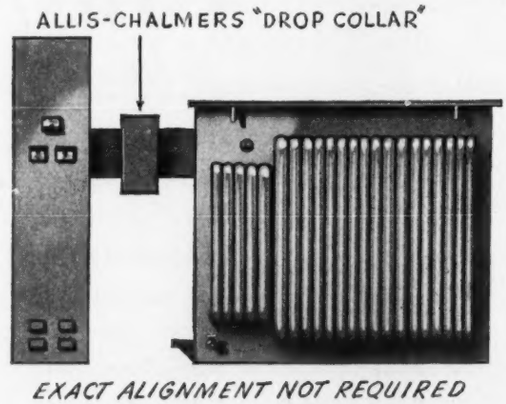


Savings on Deliveries! Because Allis-Chalmers Load Center Unit Substations have been standardized, there are no "specials" that hold up production by causing delays on the drafting board or in the shop. Yet these units are flexible to meet your exact requirements.



Savings in Production! Eliminating low voltage runs gives you lower losses, improved regulation, better motor and lamp performance in your plant.



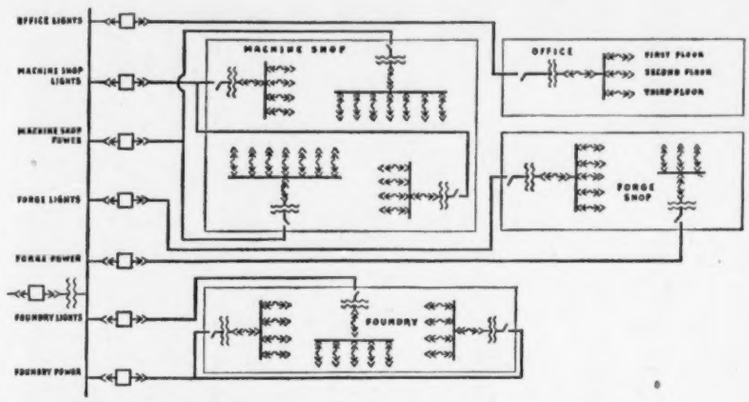


Savings in Installation! No exact alignment of the equipment is required. The Allis-Chalmers "drop collar" is used on outdoor and on the high side of load center units. On the low voltage side of load center units, flexible-cable connection is made inside switchgear cubicle. And because Allis-Chalmers Load Center Unit Substations are factory-assembled, there's no wiring to be done in the field. Nor is it necessary to construct any special foundation or fireproof vaults.

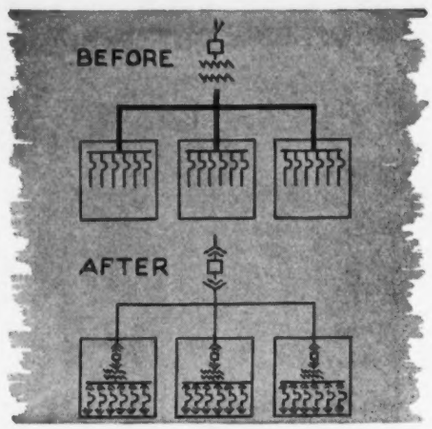
ALLIS-CHALMERS

for Savings!

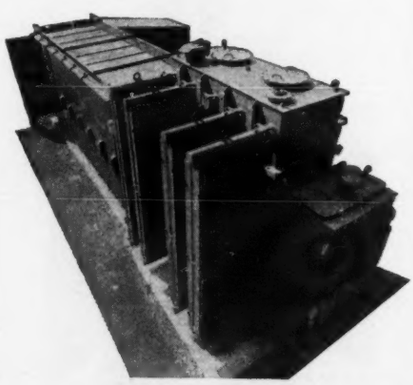
save drafting board delays, giving you faster deliveries. you save important amounts of copper for the war effort!



Savings During Blackouts! Load Center Unit Substations make it easier to use separate lighting and power circuits. Lamp flicker is reduced . . . and blackout control of lighting can be achieved without killing power circuit and interrupting production.



Savings in Copper! Installed right at the machines they serve, load center unit substations eliminate long runs of heavy secondary cable.



Savings in Space! Compact design of Allis-Chalmers outdoor Unit Substations saves space. If load center shifts, these packaged units are easier to move.

All this — and flexibility, too!

THE savings you make with standard Allis-Chalmers Load Center Unit Substations add up to a big wartime *and peacetime* engineering advantage. And there's no penalty attached...

For even though these units have been standardized, you still get your choice of a wide variety of high and low voltage connection. On the high side you can have disconnect switches, oil fuse cutouts, metal-clad switchgear, direct connection to roof bushings, or throat connection to bus run. On the low side, stationary or drawout air breakers can be electrically or manually operated. Transformers can be Chlorextol-liquid-filled or dry-type.

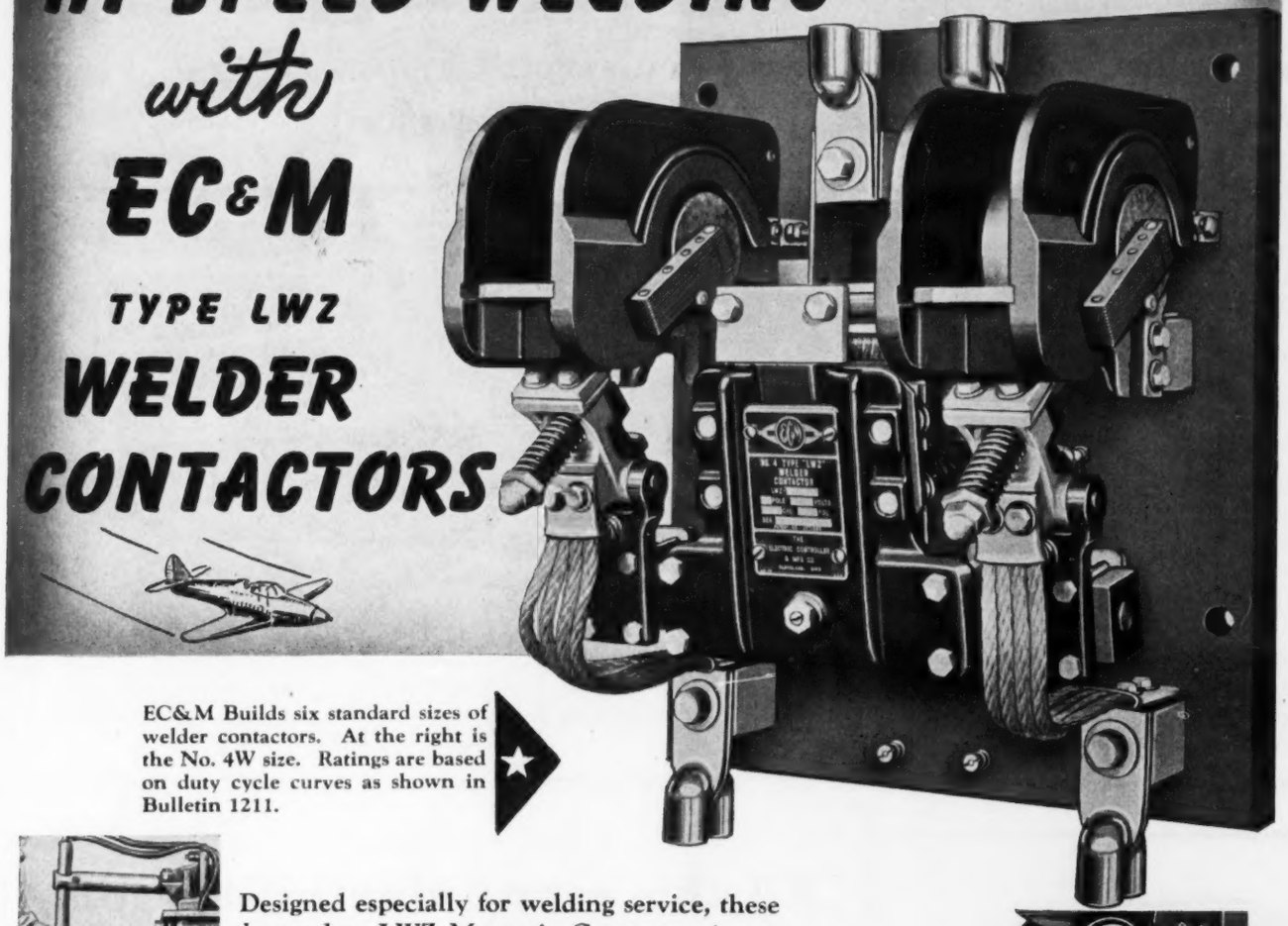
To learn why buying Standard Load Center Unit Substations is smart buying for *you,* call the district office near you. Or write ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1572

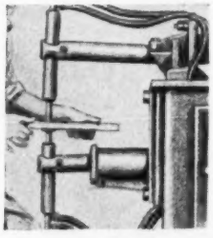
UNIT SUBSTATIONS

WE WORK FOR VICTORY WE PLAN FOR PEACE

CONSISTENT RESULTS in HI-SPEED WELDING with EC&M TYPE LWZ WELDER CONTACTORS



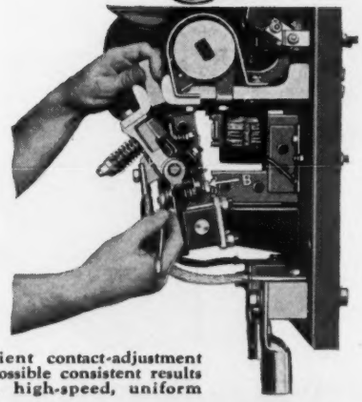
EC&M Builds six standard sizes of welder contactors. At the right is the No. 4W size. Ratings are based on duty cycle curves as shown in Bulletin 1211.



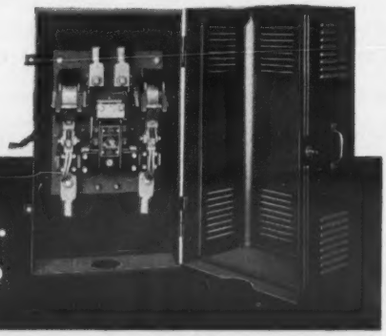
Designed especially for welding service, these *heavy-duty* LWZ Magnetic Contactors *insure good welds at low cost.* Readily accessible contact-adjustment means high-speed uniform opening and consistent welding results.

All contacts are pure copper, cold-formed by a special process providing high Brinnell hardness throughout their thickness. Proper cushioning and skillful design eliminate bounce in both opening and closing. Continuous capacity operating coils are capable of frequent operation in welder service and are well suited for "heater" and similar applications where the contactor may be closed for a long period of time.

High in arc-handling ability, low in upkeep, these EC&M Type LWZ Contactors have no equal. Ask for illustrated Bulletin 1211.



Convenient contact-adjustment makes possible consistent results through high-speed, uniform opening.



THE ELECTRIC CONTROLLER & MFG. CO.

2698 E. 79th Street CLEVELAND, OHIO

WE'VE TRAPPED A LAW-BREAKER

Well-made suspension insulators are astonishingly law-abiding. Thousands upon thousands operate safely within the Law of Averages for strength. But average strength is an admission of variation both above and below normal--how far above and how far below? Well, that's the question! Away out on the low end may be just one law-breaker, but that's all it takes to make trouble, for it's worth remembering that while 10,000 insulators may be needed to hold up a line, it takes just one to drop it--one violator of the Law af Averages. In building O-B suspension insulators, *we* don't trust the Law of Averages simply because *you* can't... Contrary to other methods of manufacturing suspension insulators, O-B maintains a rigid minimum value for strength below which not one single unit may fall. Variations which naturally exist, all occur *above* a safe known standard, not on both sides of some arbitrary point... By applying specific strength values to every insulator, no matter how many, O-B gives you the kind of strength that *counts*--because you can *count* on it!

KEEP 'EM HOT

Into every piece of military equipment goes some form of electricity. Flow of war goods is directly influenced by the nation's uninterrupted flow of power. By O-B's method of suspension insulator inspection and rating, you know the specific strength of every unit--it's marked on the cap. You likewise know that not one unit in a crate or a carload falls below this strength value. It costs nothing more to get. For maintenance, re-insulation of lines, or any new construction, be on the safe side--specify O-B--and may your lines always be hot!

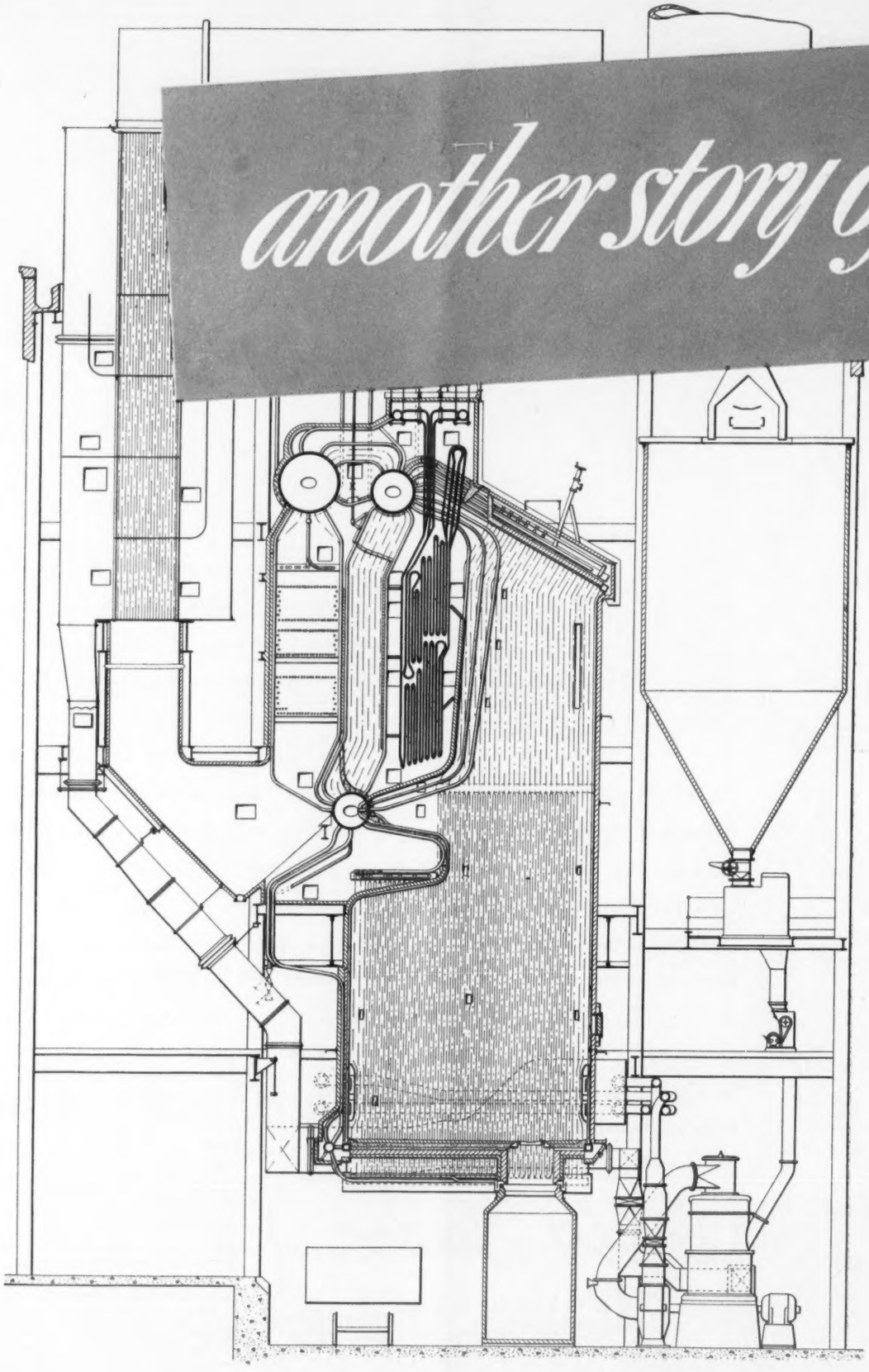
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co. Ltd., Niagara Falls, Ont.

40C-H

another story of



The performance record described at the right was accomplished by two C-E Steam Generating Units of the type illustrated above. Maximum continuous capacity — 250,000 lb of steam per hr. Design pressure—775 psi. Total steam temperature— 910°F.

STEAM AT WAR

Somewhere in the mid-west there's a new power station that serves an important area of a great industrial state. Its 50,000 kw turbo-generator is supplying the power on which depends the production of ordnance and munitions; machine tools and chemicals. It also provides electricity for important coal mining areas and even serves Army and Navy air bases and camps.

FORCED OUTAGE—1%

How dependably two modern C-E Units are supplying the steam for this turbo-generator is evidenced by data of recent performance covering a period of approximately 17 months. The forced outage time during this entire period for the two units combined was only 1% of all the available hours.

HIGH AVERAGE OUTPUT

During these 17 months, the average output for each of the two units (rated at 250,000 lb maximum continuous capacity) was 224,000 lb of steam per hr.

BETTER THAN THE GUARANTEE

Furthermore, the combined overall efficiency of the two C-E Units was 88.74%—well above the original guaranteed performance.

★ ★ ★

Thus the evidence accumulates to show why this global war found our country prepared with more power capacity than all the nations of the Axis combined. The reason for this fortunate situation is the long established policy of the American public utilities which have consistently sought improved equipment in order to produce power more efficiently, more dependably and more abundantly. That's why *power* was among the readiest of America's implements of war.

COMBUSTION ENGINEERING

A-705

200 Madison Avenue, New York, N. Y.

MICA INSULATOR COMPANY

● Remember, the main cause of motor breakdown is insulation failure . . . and the money saved on one motor rewind job more than pays the cost of Fiberglas over class "A" insulation.

● When properly combined with varnishes, resins or mica, Fiberglas gives you all these performance advantages: — Higher temperature and moisture resistance, better space factor, higher mechanical strength.

● For Fiberglas at its best, get it from Mica Insulator Company — the only manufacturer making all three types listed — making them the *Insulation Headquarters* way — to help step up motor life, cut servicing and repairs on wartime production. Use the coupon below for prompt action.

VARNISHED

Continuous fiber yarn impregnated with specially-developed Empire insulating varnish—for motor and generator coils, transformer and control coils.

LAMINATED

Fiberglas cloth impregnated with plastic resins, laminated under heat and pressure and furnished in sheets or fabricated to size—for slot wedges, coil separators and end pads.

COMBINED WITH MICA

Carefully overlapped mica splittings reinforced with Fiberglas on one or both sides—for slot liners, phase insulation and insulating small parts in switch gears and wiring devices.

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VARNISHED FIBERGLAS_____

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ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

HOW TO SOLVE
Operating Problems
with *Correct Lubrication*

Fight Heat, Pressure, Oxygen

PROBLEM: Heat, pressure, oxygen attack a Diesel lubricant between the faces of the rings and the cylinder wall (1, above) and between the rings and grooves (2, above). Its use as a coolant (3, above) also subjects it to oxidation. The lubricant must resist these attacks or it will form deposits, interfering with ring action and piston cooling.

ANSWER: A line of famous Gargoyle Oils is made specifically for this purpose: *Gargoyle D. T. E. Oils Nos. 1 to 5.* In even the most severe Diesel operation, these oils resist oxidizing influences. They form a tenacious film that resists the wiping action of the piston rings. Wear, ring breakage and blow-by are all minimized. Piston cooling remains at maximum efficiency.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

SIMPLEX...

Insulated Wires and Cables must conform to war-time regulations now and "for the duration" but they retain the properties necessary for satisfactory service.

Into them we are putting the accumulated "know-how" of nearly sixty years devoted exclusively to making wires and cables with rubber, varnished cambric, impregnated paper and plastic insulations.

Shortages of many of the materials normally used in insulated wires and cables have seriously upset production schedules but expert use of what is available is breaking production bottlenecks caused by restrictions designed to conserve and control "critical materials."

The background of knowledge and skill built up during more than a half century now enables us to make the most of the limited materials we can get.

If you are doing essential, high priority war work and must have new cables we shall be glad to tell you more about Simplex cables and what they can do for you.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex

WIRES and CABLES

NEW THINGS ARE COMING Fast!

IN laminated plastic materials, as in so many others, the new conditions imposed by war have led to intensified research which has developed new products and new qualities that are certain to be valuable after the war.

Formica, with the assistance of customers and suppliers, has had a share in this progress. Some of the new things: laminated plastic name plates, glass cloth base insulating material to serve some of the uses of ceramics; arc resistant insulation, "Pregwood", a light, strong, impregnated wood that serves many mechanical uses, and fluorescent instrument panels visible in the dark.

When the war is over let us tell you about the new things in Formica that might serve you better.

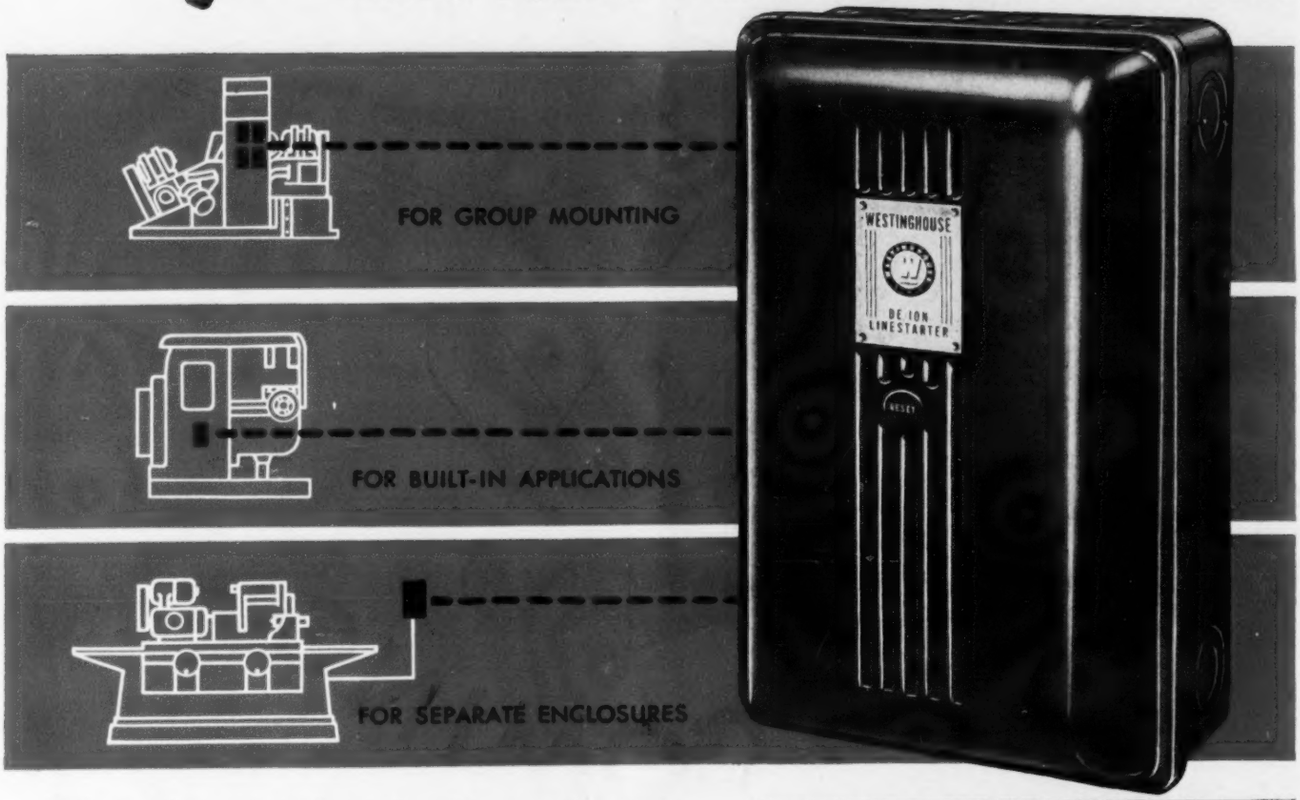
FORMICA

THE FORMICA INSULATION COMPANY, 4630 SPRING GROVE AVE., CINCINNATI, OHIO

NEW LINESTARTER

FITS PERFECTLY

INTO TODAY'S MACHINE TOOL PICTURE



Both in size and performance, this new Linestarter measures up to the requirements of modern machine tool design for compactness, easy mounting and dependable, trouble-free operation.

It is compact—ideal for group mountings and built-in applications. No crowding—all parts are quickly front-accessible.

It is flexible—coil is front-removable. Overload relay may be adjusted for either manual or automatic reset.

Sturdy and efficient, it is designed to give across-the-line starting, stopping, and overload protection under grueling 3-shift schedules. The armature is self-aligning—features a knife-edge bearing of nitrided steel that guarantees positive, accurate contact alignment. Service life of contacts is greatly increased by new, double-break construction.

Ask your Westinghouse representative for further details or write for Bulletin 3185. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-21254

NEW DESIGN FEATURES

SIZE 2 LINESTARTER

for A. C. polyphase motors up to 15 hp, 220 volts; 25 hp, 440, 550 or 600 volts

- **"De-ion" arc quenching—prolongs the contact life.**
- **Hand or automatic reset Bi-metal overload relay.**
- **Knife-edge bearing—an exclusive Westinghouse feature.**
- **Interlocks—space for as many as four.**

Westinghouse MOTORS AND CONTROLS

NOT HOW BIG THE MAN . . .

BUT HOW LARGE HIS SHADOW

WITH millions of dead and dying . . . the importance of the individual today would seem small indeed.

Still, maybe the way to measure a man is not by *who* he is, but by *what* he does.

That makes quite some difference.

Take the men and women now at work in the MILLER plant. Day and night they are turning out torpedo parts, bullet jacket metal, Navy wiring devices, gauges, special aircraft parts, searchlights, convoy lights, lenses, special castings, and a multitude of other war goods.

We like to believe the shadow of their usefulness looms large over the war world.

The work they are doing . . . essentially *precision* work with copper and brass and steel and aluminum . . . they do extraordinarily well. They do it by instinctive and developed skill, and by *tradition* . . . for MILLER has almost 100 years to its back in metalworking.

Today their metal craftsmanship is at your command for anything from a bushing to a modern continuous fluorescent lighting system . . . *if you, too, are working for Uncle Sam.* Tomorrow their skill will be available to everyone . . . with full benefit of all they are learning in the interim.

MILLER . . . for precision work in metal

THE MILLER COMPANY, MERIDEN, CONN. *. . . rolling brass and phosphor bronze . . . fabricating parts and fittings of metal . . . engineering and manufacturing a complete line of lighting equipment . . . domestic oil burners.*

Hot Rolled Copper Rods

Bare and Tinned Copper Wire (in rounds, flats and squares)

Bare and Tinned Strand

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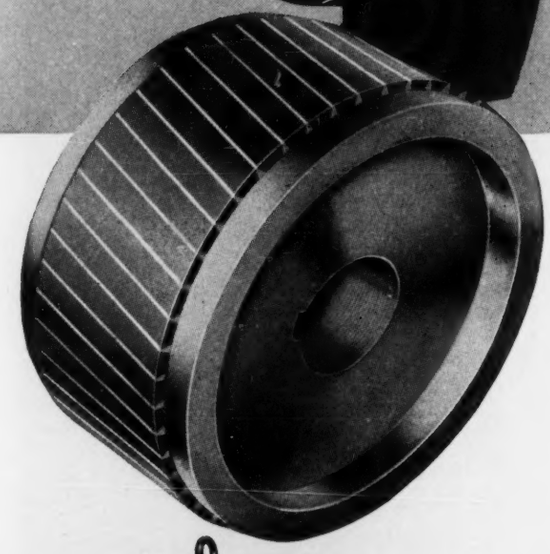
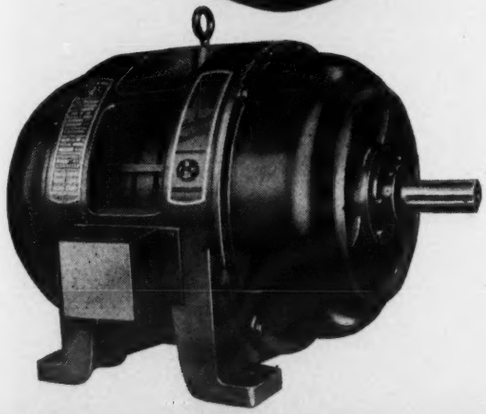
When You Can't Buy 'em *BIG*—Buy 'em *GOOD!*





REALLY, it's no hardship when you have to buy smaller motors. *You save money.* But remember, when you can't buy 'em big—buy 'em good.

Now that you cannot depend on oversize to take your motors through tough service—you must depend on quality.

That is why you should investigate Fairbanks-Morse Motors with *Copperspun* Rotors.

The winding of the *Copperspun* Rotor is centrifugally cast of COPPER in one piece. It provides electrical and thermal characteristics that give this motor the stamina to stand up under the most severe service without mechanical failure. You can operate a Fairbanks-Morse Motor with *Copperspun* Rotor at its full rated capacity continuously and indefinitely without fear of damage from overloading.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Copperspun

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ELECTRICAL MACHINERY
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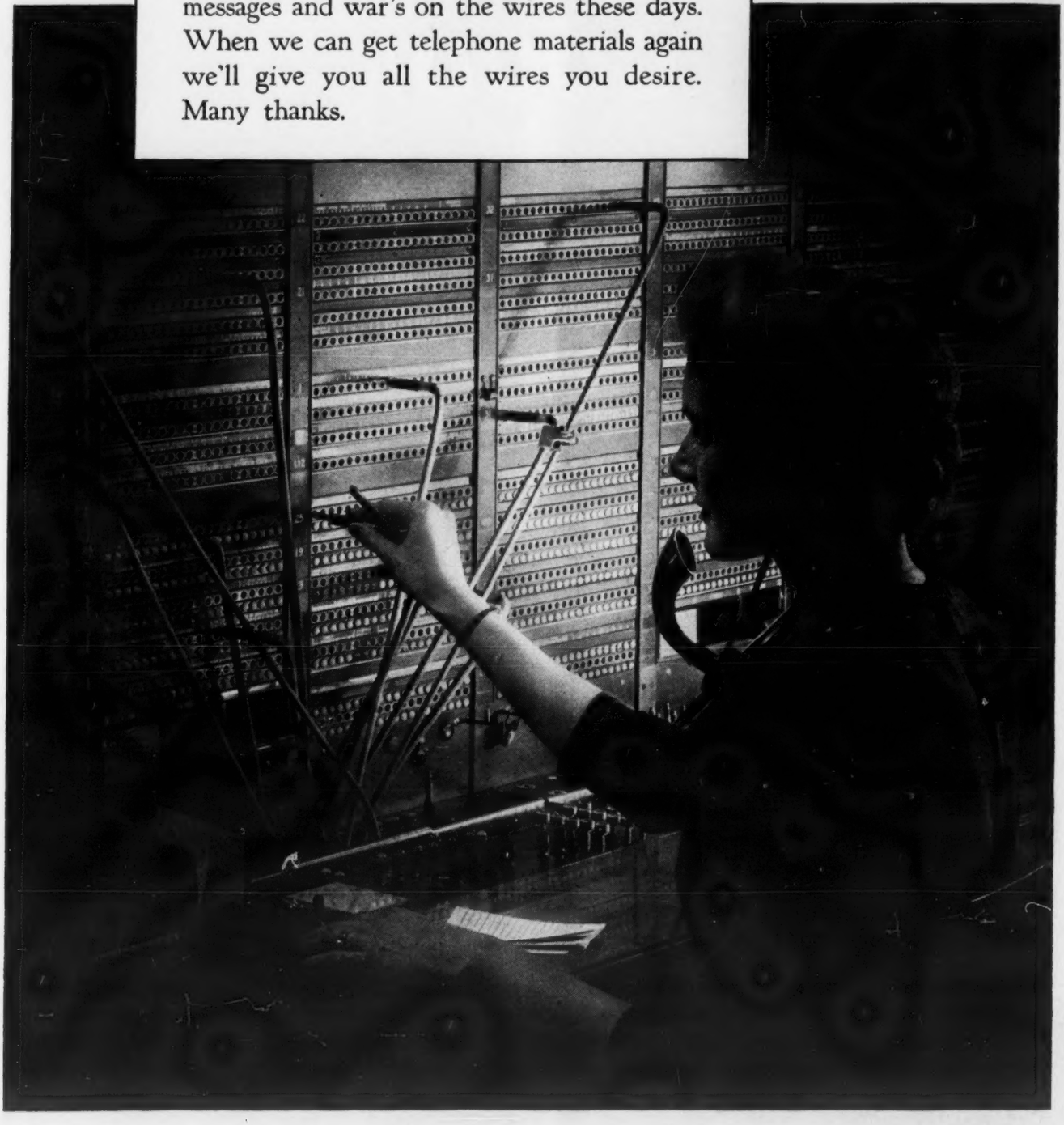
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Motors

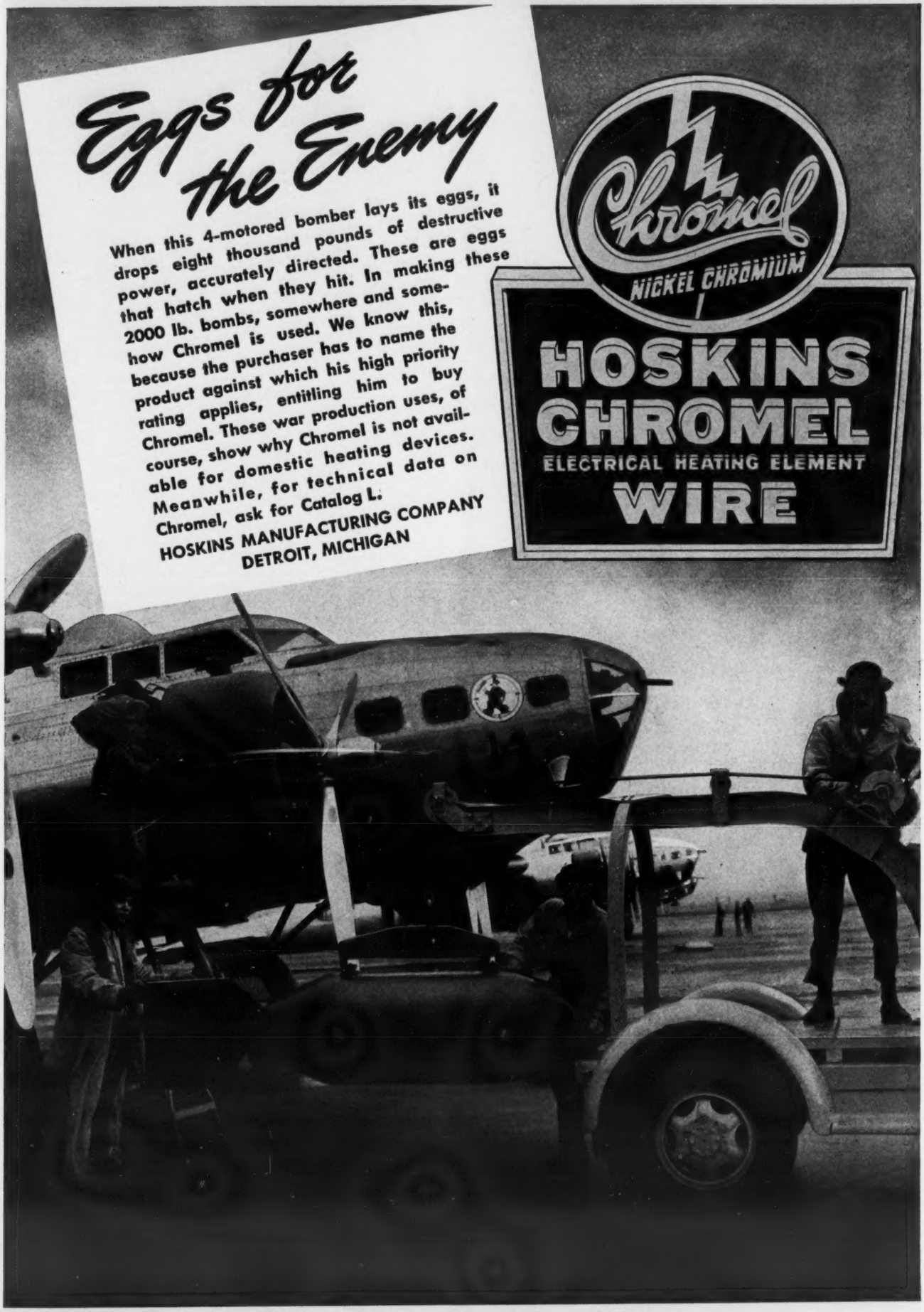
"AN URGENT CALL FOR YOU"

"Please do not make Long Distance telephone calls to war-busy centers unless it is really necessary."

That helps keep the lines open for war messages and war's on the wires these days. When we can get telephone materials again we'll give you all the wires you desire. Many thanks.



BELL TELEPHONE SYSTEM


Eggs for the Enemy
When this 4-motored bomber lays its eggs, it drops eight thousand pounds of destructive power, accurately directed. These are eggs that hatch when they hit. In making these 2000 lb. bombs, somewhere and somehow Chromel is used. We know this, because the purchaser has to name the product against which his high priority rating applies, entitling him to buy Chromel. These war production uses, of course, show why Chromel is not available for domestic heating devices. Meanwhile, for technical data on Chromel, ask for Catalog L.
HOSKINS MANUFACTURING COMPANY
DETROIT, MICHIGAN
Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

FOR OUR ARMED FORCES

INDUSTRIAL AMERICA HAS PLEDGED

ALL-OUT AND EVER-INCREASING PRODUCTION

FOR OUR ARMED FORCES

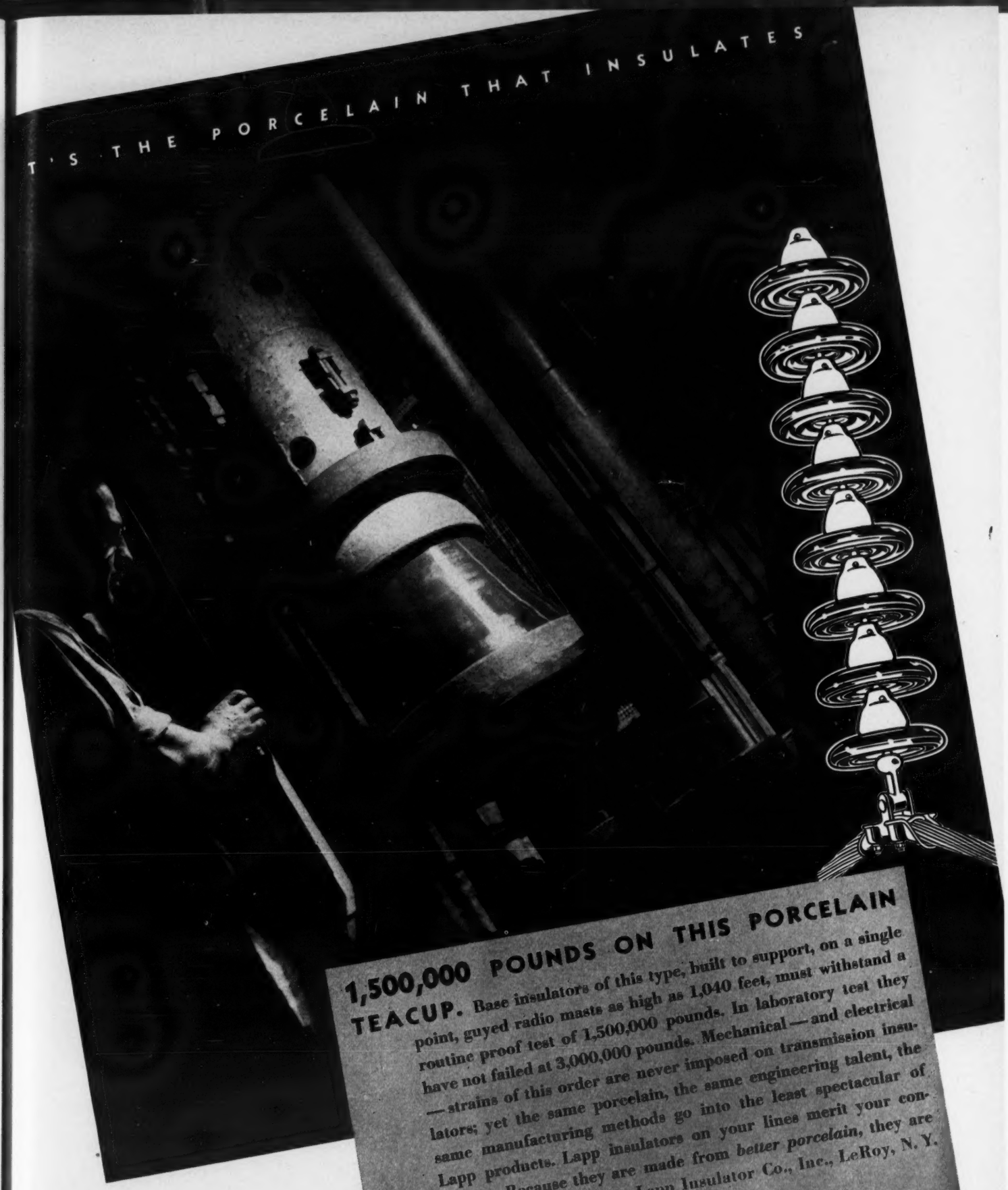
—THAT THEY MAY QUICKEN THE DAY OF VICTORY

—THAT THEY MAY RETURN IN SAFETY

—AND THAT THE WORLD MAY BE ASSURED

OF A LASTING PEACE

BETHLEHEM STEEL



1,500,000 POUNDS ON THIS PORCELAIN TEACUP. Base insulators of this type, built to support, on a single point, guyed radio masts as high as 1,040 feet, must withstand a routine proof test of 1,500,000 pounds. In laboratory test they have not failed at 3,000,000 pounds. Mechanical — and electrical — strains of this order are never imposed on transmission insulators; yet the same porcelain, the same engineering talent, the same manufacturing methods go into the least spectacular of Lapp products. Lapp insulators on your lines merit your confidence. Because they are made from *better porcelain*, they are *better insulators.*

Lapp Insulator Co., Inc., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

KERITE *Keeps Rolling Along*

For upwards of a century since Day's invention, Kerite has rolled up a record for efficient and permanent insulation, unequaled in the whole history of the electrical industry.

DAYS KERITE

THE KERITE INSULATED WIRE & CABLE COMPANY INC

NEW YORK CHICAGO SAN FRANCISCO

DAYS KERITE

Power—Giant Arm of Production

Ninety Per Cent of American Industry Is Electrified

ELECTRICITY is the mainspring that turns the wheels of our factories, mills and mines. It is the tireless arm that grinds our grain, weaves our cloth, pumps our water, builds our planes, our guns, our ships, our cars, our trucks and tanks . . .

The mighty Pharaohs had less energy at their disposal in building their pyramids than is generated today by one single power plant. The combined capacity of America's central power systems is without parallel in the history of the world . . . 46 million kilowatts, i.e., 65 million horsepower in steam turbines, hydro turbines and other prime movers. That is more power, day in and day out, than 650 million slaves could produce—for a limited time—minutes in fact.

The capacity of this vast fountain of energy is beyond the grasp of the average man who flips a switch and sets in motion machines that perform the labor of a thousand man-hours in a matter of minutes. Perhaps only the old time farmer, whose traditional source of power is a team of tired horses and a pair of calloused hands, knows how to appreciate this commodity that is so vital an ingredient of everything we consume and use.

Yes, we take electricity for granted. We expect it to appear in unlimited quantities, like water and air, as we need it. Almost as essential as these two elements in times of peace, it becomes a matter of life and death in times of war. Industry would collapse without it and the nation would quickly perish.

With the catastrophe of Pearl Harbor a little over a year ago, came the realization that we had to out-produce our enemies. To out-produce our enemies, who had a seven year head start, meant to turn more wheels than they were turning and to turn them faster than they were turning them.

New plants sprung up overnight. Production increased beyond our wildest dreams. Aircraft and shipbuilding surpassed the most daring forecasts. The machine tool industry's output grew to a volume that bordered on the miraculous. Guns, shells, uniforms, shoes, tanks and a thousand other items were being made in hitherto undreamed of quantities. All of them have one common essential ingredient – power. Industry demanded power – more and more power!

It is no small tribute to the power industry that, while other raw materials developed shortages necessitating strict priorities control, electricity remains unrationed – no priorities, no curtailments, no rate increase. Current industrial consumption is running 16 per cent over 1941 and 50 per cent over 1940. Not spectacular perhaps but when we consider that the nation's 26 million domestic consumers utilize only about 14 per cent of the energy output, we begin to get some idea of industry's power consumption.

Our power companies might have been stunned by the prospect of mounting demands for kilowatts. Instead they set about developing and coordinating a multiplicity of relatively small and seemingly unrelated factors. Individually or even collectively, these have not been of a spectacular nature. Certainly they have not inspired the award of the Army-Navy E although they are an essential ingredient in every Army-Navy E that has been awarded to American industry.

The contribution of the power industry to the winning of the war is not likely to flame forth in newspaper headlines. It takes the more prosaic turn of portraying an industry that is doing wonders quietly, unobtrusively.

At the close of the last war the power at the disposal of the American industrial worker averaged 3⅓ horsepower. At the beginning of this war, twenty years later,

This is the seventh of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

it had increased to 6½ horsepower. What other nation can even approach that figure? This large provision of power is the achievement of the electric utility industry. For years it had built and applied its equipment to the highest standards of performance and operated its systems to equally high standards of service and dependability. Always recognizing that "public service is a public trust" it had maintained wide margins of security in performance. Today these margins are the source of the power industry's ability to rise to the emergency.

In short, the electric utilities were prepared!

Power men are accustomed to looking ahead, to prepare for growing loads and allow for unforeseen contingencies, for electricity cannot be stored. It is "ordered" by touching a switch. It is delivered and consumed at the same moment.

Months before the actual outbreak of hostilities foresighted power men set to work computing how much life of equipment could be risked in the process of crowding it toward greater output. Generators, boilers, turbines, cables, transformers and even conductors underwent close scrutiny in an effort to increase the load – *safely*. They figured, they experimented, they tried untried measures.

Insulation, for example, is the crux – the least known component of electrical apparatus. When it lets go the service suffers. It is not easy to know how near any bit of crucial insulation is to letting go. It takes courage to work it to a point just short of failure . . . but that is exactly what is being done today.

Technological forcing of equipment, however, is not all of the story. Obsolescent equipment has been rehabilitated; salvage has been intensified; critical metals have been replaced by non-critical materials; water sprays, air-blowers and other cooling methods have been installed to keep over-loaded apparatus from over-heating. Nothing has been overlooked. Ingenuity has contrived the well nigh impossible.

Hand in hand with these measures of expediency have gone measures of intensification. Hydrogen pressure for cooling generators has been stepped up from ounces to pounds taking more heat away from the machines and enabling them to carry greater loads. Capacitors – little more than aluminum foil interleaved with thin paper – have been applied by the carload relieving the systems of that mysterious reactive current which is associated with that equally mysterious power factor. They have performed wonders in avoiding the need for additional generating and transforming equipment. The use of portable sub-stations has averted the otherwise necessary reserve capacity in fixed installations at many points.

When coal was placed on the urgent list last spring the electric utilities outstripped all other industries in providing storage for the winter. Stocks on hand the first of October were sufficient for 105 days, or more than twice what would be considered adequate in times of peace.

When staff losses to the armed forces became serious power companies contrived measures that enable them to get along without aggravating the national manpower situation by hiring others to replace them. Today meters are being read every two or three months instead of monthly; women are being trained to do drafting, keep the logs in power plants and sub-stations and to test meters in shops and laboratories.

On the summit of "Grandpa's Knob", a mountain overlooking Rutland, Vermont, stands a giant windmill that would have been the delight of Don Quixote. Towering 200 feet above the tree tops its mighty 175 foot propeller turns with the wind and drives a 1,000 kilowatt generator which feeds its output into the Central Vermont Public Service Corporation's power system. The most ambitious wind-turbine generator in the world, and a daring experiment of forward-looking men.

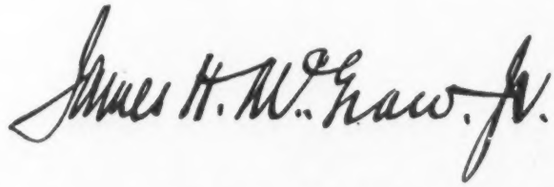
Today everything electrical is being tried; is being worked harder than it has ever been worked before.

Great credit is due the men behind the electric power industry. These men have recognized the responsibility of their jobs – it is a part of their very being. Theirs is the kind of service that *must* be maintained. No soldier is truer to his trust than is the employee of this great industry.

The service must go on! No matter what happens – acts of God or deeds of men – the service must go on! Labor disturbances may disrupt other industries but there have been no shutdowns due to labor trouble in electric power plants since Pearl Harbor.

And this winter when blizzards pile up drifts and sleet makes pavements slippery there may be absenteeism from other plants but the utility employees will be on the job ready to climb the ice-covered poles and repair the ice-laden lines whenever the call comes.

In this war the least costly yet the most precious element of production – electricity – will be ever ready to "man" the machines that will produce the weapons that will give victory to the forces of freedom.



President, McGraw-Hill Publishing Company, Inc.

Glamour

Has electric power lost its oomph? Has it become so much a part of our daily existence that we are conscious of it only when we lose it?

This startling thought arose as we read last Sunday's New York *Times* 80-page war industry section. Pages were devoted to airplanes and other pages to machine tools, and so on through. To the one raw material present in the manufacture of every one of these tools of war, without which it would be impossible to achieve the glorious production records, a meager 35 column inches is devoted.

The publishers of the New York *Times* know how important electric power is to the war effort. Their own advertisement in that same issue addressed to the electric utilities says: "Developed through the courage and initiative of the industry's leaders, it (electric power) has provided America with the basic energy without which our conversion to war production would have been impossible." Still, in an 80-page section devoted to industry's achievements, power gets 35 column inches, or one-fifth of a page.

There haven't been enough airplanes, or machine tools or ships. Copper and steel and the other metals have been short. Expansion in production facilities took precedence over everything else in priorities. The achievement since Pearl Harbor by American industry is one of the most glorious pages in our history as a free people—but it is the story of heroic efforts made by unprepared industry.

Electric power, on the other hand, was ready—never any waiting. It even had some of its expansion program curtailed. Yet its achievement was almost lost among the more glamorous stories of war industries that had expanded production several times.

Yes, these other industries have done a more exciting job. The electric power industry has done nothing more spectacular than to have been ready ahead of time, to have never denied service, to have taken no holiday, to have caused no inconveniences, to have held up no war production, to have served civilians as well as the military, to have maintained its quality.

If that isn't spectacular in wartimes it's only because those living within the power-producing industry have also come to accept electric power as commonplace. When they don't feel the romance, the glamour of the power achievement, how can we expect the public to sense it?

In peacetime the glamour of electric power is in what it produces—in this war the glamour of electric power is of itself.

There's virtue now in being ready; there's virtue now in having enough. Oil, gasoline, butter, coffee, all kinds of foods are teaching the public new lessons. Soon the things unrationed will be news—glamorous news.

But do we have to wait until then to feel the romance of being a part of the industry the preparedness of which will bring victory to our nation and freedom to the world?

Harbor Plant Designed for Economy, Quick Pick-up

Largest 3,600-r.p.m. tandem-compound unit to pick up 60,000 kw. instantly — Study shows 850 psi. and 900 F. most economical — Twin condenser to ease seismic strains

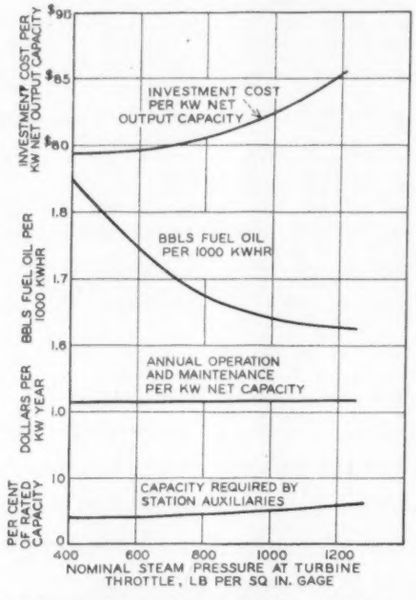
WILLIAM C. ROWSE, Steam Design Engineer, Los Angeles Bureau of Power and Light

SINCE the greater proportion of the energy supplied to the Power Bureau* system comes from hydro-electric generating plants it was decided that the size of the first steam turbine-generator unit of the Harbor steam plant would be about the same as the delivered capacity of one generator at Boulder Dam, namely, 60,000 to 75,000 kw., and that the general characteristics should be suitable for operating in parallel with hydro-electric generating plants, including the ability to pick up full load instantly when floating on the line at a light load.

Economic Studies

As this was the first unit of a new steam plant it afforded an occasion to explore the comparative initial and running costs of plants of several feasible steam pressure-temperature combinations and a series of economic studies were made based on the ultimate capacity of approximately 300,000 kw. and on the net sendout from the plant, special care being taken to make all results truly comparable.

A series of economic studies shows that as the steam pressure and temperature are increased the investment cost advances at an increasingly rapid rate, but that the fuel consumption goes down at a decreasing rate; that running expense is practically uniform for all pressures, and that the power required by auxiliaries increases rapidly with an increase in steam pressure.



LOS ANGELES ANALYSIS shows rising investment costs and auxiliary power for high-pressure design offset in part by improved economy

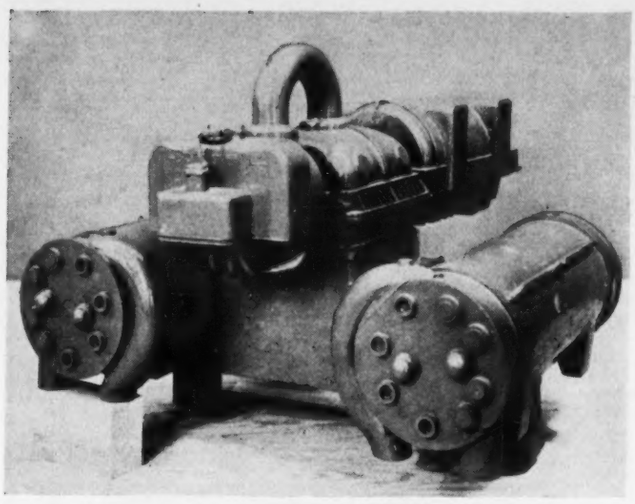
The accompanying table (with carrying charges on investment taken at 6.8 percent) presents the results of this study and indicates that, from the standpoint of economic cost, the nominal steam conditions at the turbine throttle should be 850 lb. per square inch gage and 900 deg. F. Similar studies were made of different sizes and types of turbine-generator units which resulted in the final selection of a 65,000-kw., 3,600-r.p.m., 0.80 power factor, tandem-compound turbine-generator unit (the largest 3,600-r.p.m. unit manufacturers were prepared to build). This selection was arrived at partly because of the above economic studies and partly because of other considerations. Among the latter was the important factor that the small dimensions of the high-pressure cylinder are particularly suitable for instantaneous pick-up of load, since the rapid change of temperature from 700 F. at light load to 900 F. at full load in three to five minutes will only affect the relatively small high-pressure turbine.

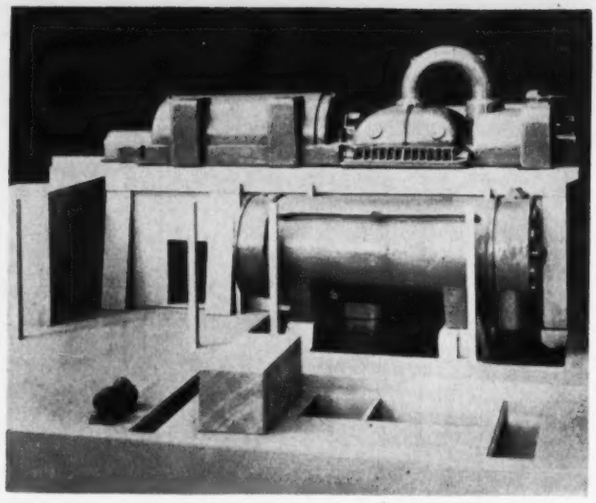
It was also decided that steam should be supplied by a single steam-generating unit having a continuous capacity of 570,000 lb. of steam per hour (corresponding to 65,000 kw.) and a two-hour capacity of 675,000 lb. of steam per hour (corresponding to overload at 75,000 kw.), designed to burn fuel oil or natural gas.

Quick Pick-Up of Load

Requirement of quick pick-up of load especially affected the design of the boiler. When the turbine-generator unit is floating on the line carrying 5,000 kw. load the turbine is operating on a "blocked" governor and consuming steam at the rate of 60,000 lb. per hour, under which conditions the furnace is burning fuel oil at the rate of 4,320 lb. per hour. When the load on the turbo-generator unit is instantly increased to 65,000 kw. the momentary slowing of the speed of the turbo-generator unit trips the blocked governor, the turbine throttle opens to a point determined by a pre-set load-limiting device and the rate of steam flow almost instantly

* Bureau of Power and Light of the Department of Water and Power of the City of Los Angeles, California, is a municipally owned corporation serving electrical energy to all consumers within the city limits except street railways. For brevity it is referred to as the "Power Bureau."





MODELS for plant arrangement show twin condenser

increases from 60,000 lb. per hour to 570,000 lb. per hour. But it will take 20 to 25 seconds to increase the firing rate of the fuel, and during that period the additional steam required to carry the additional load will have to come from the accumulator effect of the heat stored in the hot water in the boiler.

Heat stored in the hot water is changed into steam by a drop in the boiler pressure, which drop is limited by the lowest steam pressure at the throttle at which the turbine can carry this load. For this maximum permissible drop in pressure each pound of water in the boiler will release a given amount of heat in the form of steam. It, therefore, follows that the higher the initial pressure in the boiler when the turbo-generator is carrying 5,000 kw., and the greater the amount of water in the boiler, the greater the amount of stored energy available during the 20 to 25-second period required to increase the rate of burning fuel to a rate greater than the 50,000 lb. of fuel oil per hour required to produce 570,000 lb. of steam per hour, which will not only stop the drop in boiler pressure but will put back the heat necessary to restore, in a few minutes, the normal boiler pressure and temperature of steam. Therefore, the boiler specifications provided for the largest practicable volume of water in the boiler and that steam pressure be kept constant in the steam drum.

The main auxiliary bus may be energized from one of three sources, namely, (a) the outside system for use when no other source is available; (b) the main generator terminals through a step-down transformer, used for normal operation, and (c) a 4,000-kw. condensing steam turbine-generator unit for reliability during emergencies. Also, when necessary, the 4,000-kw. unit can carry the load of the auxiliaries in the station, thus making the entire capacity of the main turbine available to the system. This last consideration alone justified the 4,000-kw. condensing turbine-generator unit economically.

Heat Balance

An accompanying illustration shows diagrammatically the heat balance of the station, the principal features of which are: Placing the deaerating heater in the No. 3 position instead of the No. 2 position; arranging the heaters vertically one above the other, thus obtaining gravity flow for cascading drips, both of the above being considered essential for operating at low loads over long periods of time; recirculation of condensate through the generator hydrogen coolers, the oil coolers, the steam jets and the main steam condenser at low loads to maintain the temperature of the condensate at not greater than 100 F., and recirculation of water pumped by the boiler feed pumps at low loads. The calculated over-all thermal efficiency of the entire plant is about 11,400 B.t.u. per kw.-hr. net station sendout at 75 percent load with fuel oil at 6,250,000 B.t.u. per barrel.

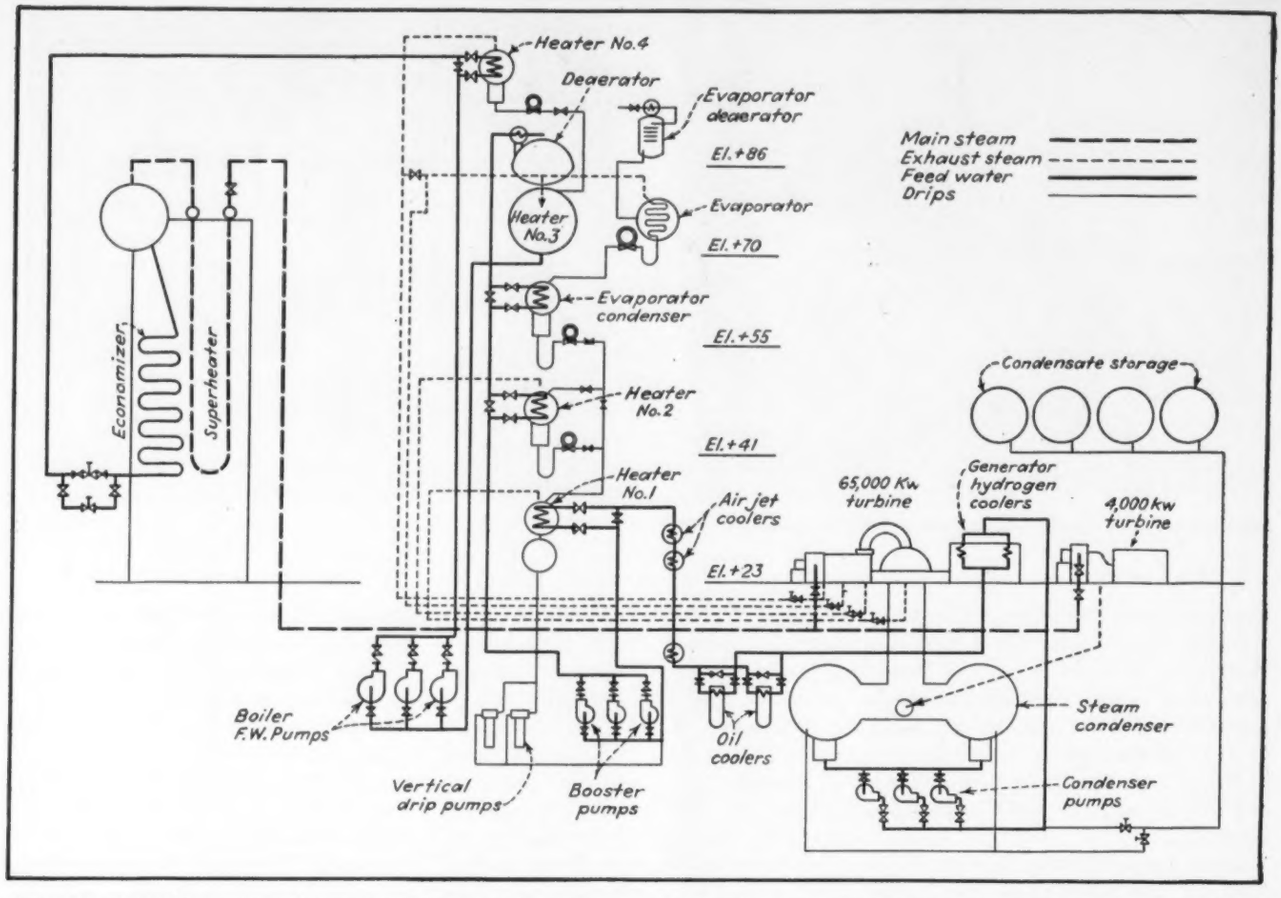
Automatic Control

Automatic control of the rate of firing and the steam pressure in the main steam drum is effected by one set of automatic control equipment. The rate of steam flow is the primary control element which operates a master controller, which in turn con-

Comparative Annual Costs per Kilowatt of Net Plant Capacity Based on the Ultimate Installation

Four 75,000-Kw., 1,800-R.p.m., Single-Cylinder Turbo-Generator Units

Annual Capacity Factor	5%	10%	20%	40%	60%	80%	100%
Fuel at $0.90 per Bbl.	Dollars per Year per Kw. of Net Capacity						
400 psi.-g.— 750 F.	7.92	8.65	10.10	13.00	15.92	18.83	21.73
650 psi.-g.— 825 F.	7.92	8.60	9.97	12.67	15.41	18.13	20.86
850 psi.-g.— 900 F.	8.09	8.74	10.05	12.66	15.28	17.89	20.51
1250 psi.-g.— 900 F.	8.31	8.96	10.24	12.81	15.37	17.94	20.51
Fuel at $1 per Bbl.	Dollars per Year per Kw. of Net Capacity						
400 psi.-g.— 750 F.	8.07	8.88	10.49	13.72	16.96	20.19	23.42
650 psi.-g.— 825 F.	8.07	8.82	10.34	13.36	16.39	19.41	22.44
850 psi.-g.— 900 F.	8.23	8.95	10.41	13.31	16.22	19.12	22.03
1250 psi.-g.— 900 F.	8.45	9.17	10.59	13.45	16.30	19.15	22.01
Fuel at $1.10 per Bbl.	Dollars per Year per Kw. of Net Capacity						
400 psi.-g.— 750 F.	8.22	9.11	10.88	14.44	18.00	21.57	25.11
650 psi.-g.— 825 F.	8.22	9.04	10.71	14.05	17.37	20.69	24.02
850 psi.-g.— 900 F.	8.37	9.17	10.77	13.96	17.16	20.35	23.55
1250 psi.-g.— 900 F.	8.59	9.38	10.94	14.09	17.23	20.36	23.51



STATION ECONOMY calculated at 11,400 B.t.u. at 75 percent load; heaters arranged vertically, to cascade drips (levels indicated are approximately as installed); simplified diagram

trols the rate of fuel flow and the speed of the variable-speed forced- and induced-draft fans. The secondary, or correcting, element is the steam pressure in the main steam drum. These are again corrected to maintain the proper fuel-air ratio and, finally, the speed of the forced-draft fan is corrected to maintain the proper pressure in the furnace.

The automatic combustion control utilizes standard pneumatically actuated fast-acting equipment. As the controlling factor for quick pick-up of load is the time required for accelerating the speed of the draft fans, this time is kept to a minimum by using large d.c. motors for fan drives, each with speed ranges from 7 percent to 150 percent of fan speed at rated capacity, utilizing the Ward Leonard type of control for speed regulation. The automatic combustion control acts directly on the field rheostats of the d.c. generators which provide power to the fan motors.

For automatic control of water level in the main steam drum the three-element control system is used, which equalizes the steam flow out of the boiler and the water flow into the boiler and corrects for water level in the main steam drum.

Amount of condensate pumped by the booster pumps and the condensate pumps is automatically controlled by the water level in the No. 3 heater storage tank.

Condensate level in the hot wells is kept within desired limits by a make-up and draw-off system automatically controlled by floats in the hot wells. There is also an automatic control to maintain the temperature of the condensate at not greater than 100 F. and recirculation of the condensate at low loads as has been described previously.

A minimum flow from the boiler feed pumps is maintained by automatically controlled by-pass valves.

Twin Main Steam Condenser

In Los Angeles it is necessary to design for seismic shock and in order to keep the cost of structures and foundations down it is extremely desirable to keep the center of gravity of all loads as low as possible. One of the principal features contributing to low center of gravity is the twin main steam condenser (see accompanying illustration), consisting of two horizontal condensers, one on each side of the turbine, standard in all respects except that they have a horizontal entrance to the steam chamber.

A connecting piece with suitable baffles connects the conventional downward low-pressure turbine exhaust to the entrances to these condensers. The advantages of this one departure from standard design are lowering the center of gravity of the turbine-generator unit some 15 ft., broadening the combined foundation for the main turbine-generator unit and the condenser, permitting the mounting of the condensers solidly on foundations without spring supports and permitting the turbine room operating floor to be on the same level as the boiler room operating floor and only 5 ft. higher than the ground level.

How Much Overload by Spray-Cooling Transformers?

Self-cooled top-oil rise reduced by two-thirds — Hotspot the criterion for overloads exceeding 50 percent — Quart per minute per kilowatt loss

V. M. MONTSINGER and P. M. KETCHUM,* General Electric Company, Pittsfield, Mass.*

TO AID in the war effort under emergency conditions, the A.I.E.E. transformer subcommittee has prepared an interim report † on this subject which recommends higher short-time overloads than those given in the A.S.A. Guides, C-57.3. These are for rare emergency conditions and entail a moderate sacrifice of apparatus life. This report also suggests different methods for increasing both short-time and continuous overloads of existing transformers.

Among the methods suggested in this report are forced-air cooling, external oil coolers, water-spray cooling and the use of annual equivalent ambients instead of daily average ambients with the 1 percent rule. This rule states that transformers will carry 1 percent overload for each degree Centigrade that the air is below 30 C. for self-cooled transformers (maximum overload 30 percent), and 1 percent for each degree that the water temperature is below 25 C. for water-cooled transformers (maximum overload 25 percent).

This article deals with the use of water-spray cooling under emergency conditions.

Water-Spray Cooling

Water-spray cooling of self-cooled transformers offers an excellent way to obtain heavy overloads on existing transformers under rare emergency conditions, although when this method of cooling is employed over long periods of time the following problems should be considered:

1. The cooling surfaces must be closely watched to prevent undue rusting.

2. Most fine spray nozzles will become clogged in time with rust particles and impurities in the water.

3. Spraying water on a tank creates a sloppy condition.

However, when this spray cooling method is used for emergency conditions the above-mentioned difficulties are less serious. The electrical engineer has to determine what load can be safely carried. Since the oil temperature rise is quite low, neither it nor the average winding rise can be used as a guide in the loading, owing to the high internal temperature gradients set up in the windings under heavy overload conditions. The output of a transformer in which the load is approximately 1.5 times or more of its nameplate rating should be based on its hottest-spot temperature rather than its average winding temperature, since the two methods give a considerable difference in the permissible overloads, as shown later.

The best spray cooler is one that keeps the cooling surface wet using the least amount of water. Various kinds of sprayers are on the market, ranging from those giving a heavy fog to those throwing out a copious amount of water as used in quenching fires.

Experience has shown that very satisfactory results, expressed in terms of loss dissipated per gallon of water, are obtained by using sprayers that give fairly fine streams of water, but not so fine that the openings will soon become clogged. A simple "home-made" spray can be made by drilling approximately $\frac{1}{16}$-in. holes in piping, arranged so that each cooling tube receives a spray of water near the top. If two rows of tubes are close together (not over 12 to 15 in. apart) one pipe can be used to spray both rows. In the case of round-tube radiators that are not more than four rows of tubes in width, one such pipe placed on each side will supply sufficient water to keep the tubes wet. The amount of water required will be approximately $\frac{1}{4}$ gal. per minute per kilowatt of loss.

With such an arrangement tests have shown that the top oil temperature rise for a given loss is decreased to approximately 30 percent of the self-cooled top oil rise. The top oil rise over the cooling water temperature increases as $(\text{loss})^{0.8}$, the same as applies for self-cooling.

With this as a foundation, and if one knows what the hot-spot rise over the top oil is at rated load, it is possible to estimate very closely the amount of overload that can be carried when water-spray cooling is used —for any specified hot-spot temperature—since the hot-spot rise over the top oil also increases as $(I^2R)^{0.8}$.

Typical Case

The following shows the overload that can be carried when cooled by water-spray (based on not exceeding a 65 deg. hot-spot rise) with a self-cooled transformer having the following characteristics at rated load:

Hot-spot rise	= 65 C.
Top oil rise	= 45 C.
Loss ratio $\left(\frac{\text{copper}}{\text{iron}}\right)$	= 2:1
Time constant ‡	= 3.0

At rated load and with the water-

*Power Transformer Engineering Department.
†See September issue of *Electrical Engineering*.
‡The "time constant" is the time required to reach 63 percent of the ultimate temperature rise over the initial rise.

spray cooling, the top oil rises would be

$$45 \times \frac{30}{100} = 13.5 \text{ C. over the cooling water temperature.}$$

By trial it is found that 158 percent load produces a hot-spot rise of 65 C. That is:

$$\left[\frac{(1.58^2 \times 2) + 1}{2 + 1}\right]^{0.8} \times 13.5 \text{ C.} = 23.4 \text{ C.}$$

For hot-spot rise over top oil:
$(1.58^2)^{0.8} \times 20$ C = 41.6 C
And for hot-spot rise over ambient: 65.0 C

On the other hand, 185 percent load would be required to give an average winding rise of 55 C. The hot-spot rise for 185 percent load is 82.7 C., or 17.7 C. above the conventional rise of 65 C. This shows that permissible heavy overloads should not be based on average winding rise, but rather on hot-spot rise.

Additional Load

A further additional load can be obtained with water-spray cooling when the temperature of the water is below 25 C. For example, if the water temperature is 10 C., by the 1 percent ambient rule an additional load of 15 percent or 158 + 15 = 173 percent load can be carried.

A curve of permissible loads versus top oil temperatures can be drawn up for the guidance of the operator on a specific transformer.

In the above discussion it has been assumed that the overloads will be carried for several days or even a few weeks, in which case the hot-spot rise should not exceed the conventional rise of 65 C. When the overload is of limited duration, it is permissible (and logical from an economical standpoint) to exceed the 65 C. hot-spot rise even at the sacrifice of some life.

In the above-mentioned A.I.E.E. interim report the following hot-spot temperature limits are recommended (with a moderate sacrifice of life) for various times as follows:

Duration of Load Hours	Hottest-Spot Temperature Deg. C
1	137
2	130
4	125
8	120
24	110
Continuous	95

The permissible overloads for any of the above times can be calculated if the time constant for the transformer is known, by calculating the oil rise by the transient heating formula

$$\theta = \theta_u \left(1 - e^{\frac{t}{B}}\right) \quad (1)$$

θ = oil rise, deg. Centigrade
θ_u = ultimate oil rise, deg. Centigrade
B = time constant
t = duration of overload

The hot-spot rise over top oil becomes constant within 15 to 20 minutes, so that usually its ultimate rise can be used in the calculation.

Example

What is the permissible overload for the above-mentioned self-cooled transformers when cooled with water-spray for two hours' duration (following 70 percent of its self-cooled rating) with a hot-spot temperature of 130 C.?

If the cooling water temperature is 25 C., the permissible hot-spot rise is 130 — 25 = 105 C. With a time constant of 3 for the self-cooled rating with 45 C. oil rise as previously assumed, the new time constant will be

$$3 \times \frac{13.5}{45} = 0.9$$

for the water-spray cooling condition where the oil rise is 13.5 C. (for the total losses for the self-cooled rating). By equation (1) and with 0.9 time constant, the oil reaches 89.2 percent of its ultimate temperature at the end of two hours. That is, if it has 20 C. to rise or 20 C. to fall to its ultimate condition it changes

$$\frac{89.2}{100} \times 20 = 17.9 \text{ C.}$$

at the end of two hours.

The ultimate oil rise for 217 percent load (found by trial) when water-spray cooled is

$$\left[\frac{2.17^2 \times 2 + 1}{2 + 1}\right]^{0.8} \times 13.5 \text{ C.} = 36.5° \text{ C.}$$

The self-cooled ultimate oil rise at 70 percent load is

$$\left[\frac{0.7^2 \times 2 + 1}{2 + 1}\right]^{0.8} \times 45 \text{ C.} = 32.0° \text{ C.}$$

In two hours the oil will have increased 89.2 percent of the difference between 36.5 and 32.0 C. or 89.2 x 4.5 = 4.0 deg. C. That is, if the air temperature is 25 C. the oil rise at the end of two hours will be 36 C. If the air temperature should be different from the water temperature this has to be taken into consideration in the calculations. Also, the air temperature will have some effect on the oil rise, but for all practical purposes the water may be considered the ambient when water-spray cooling is used. Following are the various rises and temperatures at end of two hours:

Top oil rise over ambient	= 36 C.
Hot-spot rise over top oil $= (2.17^2)^{0.8} \times 20$ C.	= 69 C.
Hot-spot rise over ambient	= 105 C.
Cooling water temperature	= 25 C.
Hot-spot temperature	= 130 C.

Since the interim report recommends 200 percent load as the limiting emergency loading without special consideration, it will be the limit in this case.

In all cases where provision is made for placing heavy overloads on existing transformers, a check-up with the manufacturer beforehand should be made as pointed out in the A.I.E.E. interim report, to see if there are any limitations other than hot-spot temperatures such as oil expansion, pressure developed in sealed-type units, bushings, leads, soldered connections, tap changers, regulation, etc., and the thermal capability of associated equipment such as cables, reactors, circuit breakers, disconnecting switches, current transformers, etc., should also be checked.

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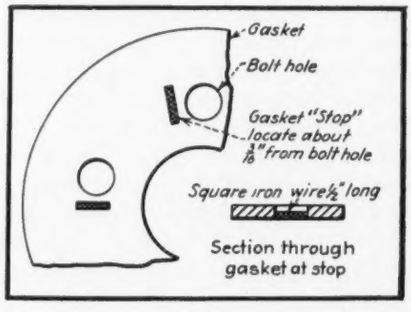
Stops Insure Correct Gasket Compression



Steel stops are inserted in cork gaskets at the reclamation department of the Oklahoma Gas & Electric Company, Oklahoma City, to obtain the correct compression of the gasket material in transformer bushings, etc., and thus insure a minimum of leakage. As shown in the accompanying sketch, rectangular slots are punched in the cork near bolt holes and short lengths of square iron wire are inserted. The wire is one-half the thickness of the cork material. Bolts are tightened until machine surfaces bear on the stops, to obtain the optimum one-half compression of the cork gasket material.

Experience Proves Worth of Mobile Substation

Indianapolis utility reports first year's experience with 2,500-kva. mobile substation — Finds experience confirms broad usefulness expectations — Constitutes high capacity transformer standby for war industries

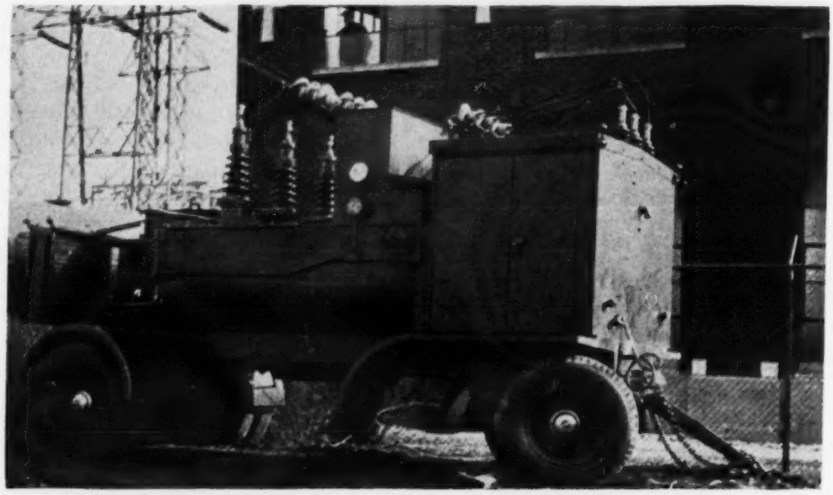
A. M. COOK, Superintendent of Substations, Indianapolis Power & Light Company, Indianapolis, Ind.

EXPERIENCE of the Indianapolis Power & Light Company with its 2,500-kva. mobile substation during its first year of service has confirmed the expectation of varied usefulness with which it was ordered.

This mobile unit was one of the largest of its kind at the date of its delivery in Indianapolis in March, 1941. Under war conditions this high capacity is considered of special importance in Indianapolis because of extensive local munition manufacturing. With its 2,500-kva. capacity the mobile substation is capable of handling emergency demands of any one of a number of major war industries. An entire residential area with several thousand customers can be handled by the unit in the event a permanent substation should be put out of service. The company has 21 district substations and ten industrial substations on its 33,000-volt transmission system.

Although no sudden emergency, such as the disabling of a substation by storm or accident, has occurred since the mobile substation was made ready for service, it has been used in a number of instances during regular system operation, maintenance and construction.

In one instance the substation served the Allison Division of General Motors Corporation, working 24 hours a day on airplane motor production for military service, while a larger substation was being installed to meet additional power requirements. At another time the mobile unit carried the load of the 61st Street substation, serving an important residential and commercial section, while



MOBILE substation undergoing operating tests at Indianapolis Power & Light Company's southwest substation

WHILE transformer is being changed at Indianapolis substation, 2,500-kva. mobile unit, inside inclosure at left, carries load

MOBILE substation connected to 33-kv. bus at Broad Ripple substation during special operation for Indiana State Fair

a larger substation was being installed, and later it was used to supply the temporary 2,000-kva. requirement during Indiana State Fair week.

Description of Substation

The mobile substation made by General Electric Co. has a 2,500-kva., 33,000/4,330-volt Y transformer section, equipped with a forced-oil circulation and forced-air cooling system. To keep within state highway weight limitations the transformer section was designed for a minimum weight of oil. Transformer core and coils were mounted horizontally in a specially designed tank. While the transformer can be excited continuously without having the cooling system in operation, the cooling system *must* be used when the substation is to be loaded. For this reason the low-voltage circuit breaker is interlocked so that it cannot be closed without first starting the circulating and cooling system.

The high-voltage transformer winding is equipped with five 2½ percent regulating taps. Automatic voltage regulation is provided in the low-voltage winding by load ratio control equipment incorporating eight 1¼ percent taps.

The mobile substation is provided with a metal-inclosed, 600-amp., 100,000-kva. interrupting rating, 15,000-volt oil circuit breaker with suitable accessories. A reverse power relay with an adjustable-voltage restraint element has been provided to clear the mobile unit from the 4-kv. line in case of a failure when operating in parallel with a permanent substation. Automatic reclosing of the breaker on secondary faults is provided by means of a three-shot reclosing relay arranged for three reclosures. The transformer is protected against over-temperature and failure of the oil circulating system by a winding temperature relay and "pressuretrol" switch, both arranged to operate an auxiliary relay that trips the secondary breaker and lock out the reclosing relay. Induction type over-current relays afford protection against overloads and 4-kv. faults. An indicating ammeter and a voltmeter, each with a transfer switch, are provided in the 4-kv. switchgear section.

Experience

During a preliminary familiarizing test a five-man crew made the station ready for service in two hours. Since then the time has been considerably reduced by spotting all probable locations of the mobile unit and showing the phase positions on the high- and low-voltage lines. This was done to eliminate phasing when operating in parallel with another station and to keep the same phase rotation when feeding radially.

With expansion of the Allison plant, provision was made to meet its increased demand by changing the supply source from 4 kv. to 33 kv. and installing a 7,500-kva., 33,000/4,330-volt transformer bank with a 10 percent plus-or-minus step-voltage regulator on the 4,330-volt side. The mobile substation was used to carry the load while this was being done since load demand was then within the rating of the mobile unit. To minimize the risk of interruption, however, the mobile unit was operated in parallel with a 4-kv. circuit feeding the Tibbs Avenue substation. The change-over was made without interrupting service to the Allison plant.

In 1937 this company installed the first of a series of unit-type substations that formed the basis for a 4-kv. primary network system. By January of 1941 the load in the area served by the 61st Street substation had grown far above the anticipated increase and beyond the kva. rating of the substation. It became necessary to suppress voltage to stay within the substation's capacity. Accordingly in June, 1941, the transformer was changed from 2,000 kva. to 3,900 kva., and while this change was being made the three 4-kv. circuits feeding into the primary network from this station were tied together and fed from the mobile substation. With its additional 500 kva. in transformer capacity the mobile unit was able to maintain normal bus voltage with a 2 percent regulation during the three weeks that the unit was in operation here.

Fiber Duct at Feed

In unit-type substations installed of late provisions have been made, within the inclosing fence, for connecting the mobile substation to main 4-kv. buses. This is done through 4-in. fiber duct terminated at preplanned locations for the mobile substation. Distance is standard so that cable used would be adaptable to all substations of this type. By providing for location of the mobile substation within the inclosure the need for the temporary fencing (see picture) has been eliminated.

The mobile substation was used at the Broad Ripple substation to serve the large Indiana State Fair. The fair load at its peak, which had amounted to 2,000 kva. in previous years, had required the installation of an additional transformer bank for the duration of the fair. This required a considerable expenditure of time, work and money, most of which was eliminated by using the mobile unit. It permits the company to set up for the extra fair load in about four hours, instead of two days.

Motor Overload Capacities Should Be Utilized

Conservative practice in the rating of motors on temperature rise allows definite increases in loadings without harm to insulation, and shortened life at even higher loadings may be justified today

C. P. BERNHART, Engineer, Westinghouse Electric & Manufacturing Company, New York Office

NOW more than ever is it necessary that every machine produce all it can with due regard to safety.

In normal times electric motor applications are made generally with a substantial reserve factor. As a result, it may be said that motor manufacturers have never received any conclusive evidence of overloading of motors by operators. Electric motors today do not fail because of overloading, but rather because of other causes such as:

1. Missapplication—that is, applying the incorrect type or rating of motor to the job.
2. Mechanical failure—for example, misalignment, high bearing loading, vibration, etc.
3. Overheating—resulting in insulation deterioration and final failure.
4. Inadequate normal or preventive maintenance.

It may seem somewhat strange that those who have been advocating in the past that motors be applied on a conservative basis should now apparently recommended just the opposite. However, a careful study has indicated that material savings in the use of critical materials may be effected by applying new motors, or relocating old ones, so that every advantage is taken of all possible favorable operating conditions to attain the final desired result of loading each motor to its limit.

No More Overmotoring

The first point in this program of taking advantage of the overload capacity of electric motors, therefore, is to eliminate overmotoring. If a drive is overmotored a whole chain of conditions are set up which may result in:

1. Waste of materials in the larger motor itself.
2. Oversized motor-starting equipment.
3. Oversized protective equipment.
4. Oversized distribution and feeder copper.
5. Oversized transformers and so on, which are reflected back into the public utility company's lines in the form of a poor power-factor load, with all its attendant disadvantages.

Now, how to go about to correct this situation:

1. *By Test*—Actually load the machine, duplicating the normal service conditions. Measure the watts input and from the generally known motor efficiency calculate the horsepower actually required to perform the work.

If load tests are not practical, although they generally are on existing installations, endeavor to make a careful comparison with the known power requirements of similar apparatus. Eliminate excessive safety factors.

2. *By Accurate Calculations*—Base these on actual production rates for specific operations (such as horsepower per cubic inch of material to be removed in the specified time). Here again eliminate excessive safety factors.

3. *By Careful Observation of Actual Operating Conditions*—Observe the ambient temperature conditions at the actual place of operation, the duty cycle and other unusual conditions, such as high humidity, water spray, hazardous gases, dirt, etc.

After an analysis of all of these factors, determine the horsepower actually required to perform the work.

Having thus determined the horsepower, the next problem is to choose the motor, and to take advantage of its possible overload capacity, which is a function of heat, time and insulation characteristics.

Insulation and Temperature

Insulation does not fail immediately at some critical temperature, but deteriorates gradually. In other words, the failure is a function of time as well as of temperature. Time and temperature decrease the mechanical strength of insulation, causing it to become more brittle and thus to disintegrate under the influence of vibration, and other mechanical forces. Electrical failure under these conditions will finally result. The question, therefore, of what temperature insulation may be operated at depends on how long a life is desired.

Data gathered over a period of years indicate that Class A insulation, which comprises the organic materials such as cotton, silk, paper, etc., has a service life of perhaps 12 to 20 years. When considering the effect of temperature only on insulation life, practical experience seems to indicate that the life is reduced approximately 50 percent for each increase in temperature of 8 to 12 deg. C. For Class B insulation, which comprises the inorganic group, such as mica, asbestos, etc., this increase in temperature to result in halving insulation life is approximately 10½ deg. C.

For purposes of standardization, the limiting insulation temperature for Class A material is considered as 105 deg. C. This is customarily referred to as the "hottest-spot" temperature. However, this value is purely a "bench-mark" or starting point of reference, since it cannot readily be determined by ordinary tests in the field.

Limiting Temperature

Temperature tests can be made in several ways, by thermometer, by resistance measurements, or by embedded detector, and none of these methods can be expected directly to indicate the "hottest-spot." For purposes of standardization again, therefore, conventional allowances are made, by which it is assumed the temperature will be lower than the "hottest-spot." These allowances are, for Class A insulation:

Thermometer method	15 deg. C.
Resistance method	5 deg. C.
Embedded detector method	5 deg. C.

If the conventional allowance is subtracted from the limiting "hottest-spot" temperature there remains a value which is called the limiting observable temperature. For Class A material this temperature is 90 deg. C. (105-15) when measured by thermometer, or 10 deg. C. more in each case if the measurement is made by the resistance or embedded detector methods. With a permissible limiting observable temperature of 90 deg. C. thermometer measurement, and assuming an ambient temperature of 40 deg. C., the temperature rise permissible, therefore, is 50 deg. C.

Normal sizes of conventional motors, of open-frame construction, are generally guaranteed for a 40 deg. C. temperature rise over a 40 deg. C. ambient or an operating temperature as measured by thermometer of 80 deg. C. Thus there is a margin of 10 deg. C. still available in a normal open motor design, which would assure long insulation life when carrying rated loads. These motors have a so-called service factor of 1.15 at rated voltage and frequency. In other words, when advantage is taken of this service factor by increasing the load 15 percent above the normal rating, the temperature rise would probably approximate 50 percent C. and, based upon a 40 percent ambient, the observable temperature would be 90 deg. F.

Of course, the inherent service factor available in 40 deg. C. rise equipment has always been recognized. It was provided to allow a greater factor of safety to take care of unknown service conditions.

Service Factor Increased

Thus, the burden on 40 deg. C. equipment can safely be increased by the service factor of 15 percent. But more can be done. In many cases the ambient temperature may average well below 40 deg. C., the ambient reference standard, keeping in mind that 40 deg. C. is 104 deg. F. It was felt, therefore, that "some of the slack" might be picked up here, to allow a further increase in motor load. The recommendation, therefore, is that on 40 deg. C. rise equipment where the ambient temperature is usually substantially below 40 deg. C., and only occasionally, or for short periods slightly exceeds it, select a motor having a nameplate rating of at most 80 percent of the actual horsepower load. This corresponds to a service factor, therefore, of 25 percent. Of course, it is recognized that where this service factor is used, and if the ambient temperature is at its maximum of 40 deg. C. during a large part of the time, that a reduction of as much as 50 percent in insulation life may be experienced. It was felt, however, that the immediate demand for the conservation of material warranted this sacrifice in the relatively few extreme cases which would occur.

On the basis of 1,750 r.p.m. open a.c. motors the recommendations are:

For Maximum Hp. Load of	Use this Hp. Motor	Instead of This Hp.	And Save This Many Lbs.
3.75	3.0	5.0	19
6.25	5.0	7.5	63
9.38	7.5	10.0	80
18.75	15.0	20.0	31
25.0	20.0	25.0	106
50.0	40.0	50.0	94
75.0	60.0	75.0	120
125.0	100.0	125.0	550

For open type, continuously rated 40 deg. C. rise, direct-current motors in locations where the ambient temperatures are usually substantially below 40 deg. C., and will only occasionally or for short periods equal or slightly exceed it, select the standard horsepower rating which is 87 percent of the actual horsepower load. This recommendation is made in the case of direct current motors to insure reasonably satisfactory life from a commutation standpoint rather than considering temperature only of the insulation as the determining factor. Thus the load increase permissible is approximately 15 percent above the normal motor rating.

Higher Rise Ratings

When applying an a.c. or d.c. motor, rated on a 50 deg. or 55 deg. C. basis, where the rated motor voltage is maintained and where the ambient temperature is usually substantially below 40 deg. C., select a horsepower rating which is at most 91 percent of the actual horsepower load. Thus the increase in load permissible over and above the normal rating of the motor in this case is approximately 10 percent.

Summarizing, therefore, the rules are:

Open, 40 deg. C. rise a.c. motors, 80 percent of actual horsepower load.

Open, 40 deg. C. rise d.c. motors, 87 percent of actual horsepower load.

50 deg. or 55 deg. C. rise a.c. and d.c. motors, 90 percent of actual horsepower load.

These figures have been reviewed by the War Production Board and issued by it as a recommendation.

The question naturally arises as to what should be done about the control equipment when associated with motors which are now admittedly overloaded.

Control equipment should be selected on the basis of the nameplate rating of the motor; *i.e.*, a 40-hp. control for a 40-hp. motor, even though the motor load may be 50 hp. However, the overload relay tripping elements, which are generally of the thermal type, must be considered separately.

Present-day thermal overload heaters are selected generally from standard tables and chosen on the basis of tripping ultimately at approximately 115 to 125 percent load. Thus in line with this new program:

1. For 40 deg. C. rise continuous rated a.c. motors, since the new motor service factor is now 1.25, select the next larger heater than listed, based upon rated motor full load current. This will permit the motor to carry 125 percent load continuously.
2. For 50 deg. and 55 deg. rise a.c. or d.c. motors using the standard heater application tables, select the heater listed as based upon rated motor full load current.
3. For 40 deg. C. rise continuous rated d.c. motors, using the standard heater application tables, select the heater listed as based upon rated motor full load current.

Under the conditions of overloading as recommended, the stalled rotor and single-phase protection provided under normal ratings will not

necessarily be obtained. Likewise it must be recognized that some increase in maintenance of contact tips, etc., and some decrease in expected life of the control apparatus over that obtained when applied on the standard basis will result. But the program will conserve critical materials.

Motor Selection Factors

In choosing motors, here are some points to be kept in mind:

1. Specify single-voltage motors only. This reduces the number of motor leads from nine to three.

2. Arrange to maintain full rated voltage at the motor terminals, remembering that motor torque varies as the square of the voltage.

3. Take advantage of operating conditions that permit the use of standard, open, sleeve-bearing motors in the place of splashproof or fan-cooled motors. In normal times fan-cooled motors are used in many applications purely because they are the best "lifetime" motors for the purpose. Often, however, the conditions are such that standard open motors can be used successfully in emergencies—and this war is an emergency. In other words, determine if fan-cooled or splashproof motors *must* be used, and if not use standard open motors. It should be remembered that fan-cooled and splashproof motors have smaller overload capacities. Hence the gain in using an open motor may be a double one.

What savings in critical materials can be effected by this procedure?

For Maximum Hp. Loads of	Use This Hp. Rating Open A.C Motor	Instead of This Hp. Fan-Cooled A.C. Motor	And Save This Many Pounds of War Material
3.75	3	5	90
6.25	5	7.5	174
18.75	15	20.0	273
50.00	40	50.0	474
125.00	100	125.0	1080

In addition, approximately 40 percent less machine and man-hours are required to produce standard open motors than for fan-cooled motors, thus releasing vital man-hours—machines as well as critical materials.

4. Use motors of the highest standard speed permitted by the application, thus keeping the frame size down, with consequent saving in the use of materials.

5. Use a.c. motors wherever possible, rather than d.c.

6. Avoid the use of multi-speed motors when single-speed, single-winding motors will do the job.

7. If d.c. motors are necessary, use the highest possible base speed and employ the narrowest speed range possible.

To sum it all up:

What has been said applies to new motors, and also to a considerable degree to existing motors. In certain cases it may be possible to "find" the larger motor needed in a plant by judicious swapping of available installed equipment, to utilize it to the best advantage. This must not, of course, be done blindly and by rule of thumb. Obviously a motor which has seen many years of hard service cannot be expected to carry overloads to the degree which may be imposed on new equipment.

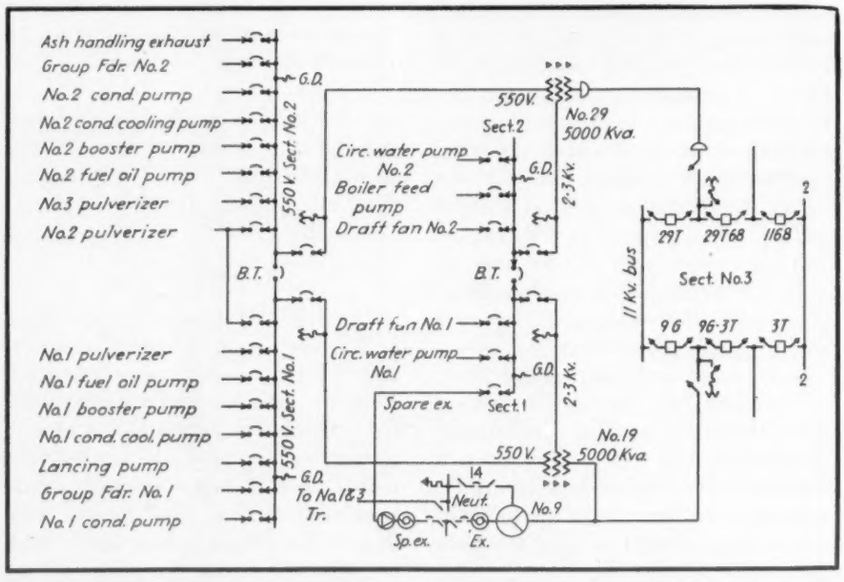
While considering the use of higher service factors, do not forget to determine whether starting and pull-out torques are adequate to meet the operating conditions. In general, they will be found satisfactory, but should be checked. Direct-current motors will, as a rule, still have a wide margin of extra starting torque under these conditions of maximum utilization of overload capacity inherent in the motors. By proper motor application as indicated here, it is estimated that up to 40 percent of the copper, steel and aluminum used in motors and motor control can be saved for our victory effort.

Insuring Auxiliary Energy Supply

In an Eastern steam plant whose equipment includes a 50,000-kva. turbo-generating unit supplied from a 1,200-psi. boiler installation, with interconnections between this station and others on the utility system, provision was made for high service reliability in supplying energy to various motor-driven auxiliaries required by this unit. The plant serves large war industries along with other consumers, and it is important to operate the above generating unit on a long-hour basis to obtain maximum fuel economy and continuity of energy delivery to these loads.

The plant layout divides the major auxiliaries into two groups as shown, with symmetrical disposition of these motor-driven units on two sets of buses, one set operated at 2,300 and the other at 550 volts. Two 5,000-kva., three-winding transformers supply energy to these auxiliary buses, and the buses in each of the voltage groups are provided with bus tie air-type circuit breakers to enable full parallel operation to be maintained when desirable. The transformers may be energized from the incoming 11-kv. tie circuits, from the main generator, or from both sources at the same time. A spare exciter for the main unit is driven from one bus section at 2,300 volts, the main exciter being direct-connected to the turbo-generator shaft.

In view of the importance of having more than one coal pulverizer always available, a connection was made between the feeder supplying No. 2 pulverizer motor from one 550-volt bus section and the second 550-volt bus section, using withdrawal type air breakers as indicated. Full breaker facilities were provided to insure complete isolation of any circuit in case of trouble.



SINGLE-LINE DIAGRAM of steam plant auxiliary connections to maintain service of maximum reliability

Capacitor Bank, 20,000 Kva., on Longview Substation

Steady rectifier load obviates necessity for synchronous condenser or for more than 2-bank subdivision of record capacitor installation

J. R. CURTIN, System Engineering Section, Bonneville Power Administration

LONG-RANGE PLANS for development of the Bonneville Power system include the future Longview, Wash., substation as a major switching station, with 150,000 kva. of 230-kv./115-kv./13.8-kv. transformation and two 20,000-kva. synchronous condensers. At present the station is arranged on a temporary wartime basis (see Fig. 1) and has two 37,500-kva., 115-kv./13.8-kv. transformer banks, fed by one 115-kv. circuit from Chehalis, 35 miles distant. Chehalis is fed by 230-kv. transmission through the J. D. Ross substation near Vancouver, Wash., from the Bonneville Dam. The total distance from Chehalis to Bonneville is 107 miles.

Fundamentally, the need for leading rkva. at Longview is exactly the same as in the majority of other power systems; *i.e.*, voltage and power-factor improvement. The 13.8-kv. load at Longview is 60,000 kw. at about 94 percent lagging power factor, resulting in a net lagging component of about 22,000 rkva. Adding to this about 4,000 rkva. for the banks, the total at the station is about 26,000. Since Longview is remote from the generating station and fed over heavily loaded lines, the advantage—from the standpoint of system performance and system voltages—of correcting load reactive is evident.

Normally, the Bonneville Power Administration installs synchronous condensers wherever leading rkva. is needed on the system, but during the present emergency, with the facilities for producing large rotating machines practically all devoted to war production, it became necessary to use static capacitors instead. Hence, the reasons for one of the largest capacitor installations in the world: (1) the imperative need for 20,000 leading rkva. and (2) the lack of synchronous condensers.

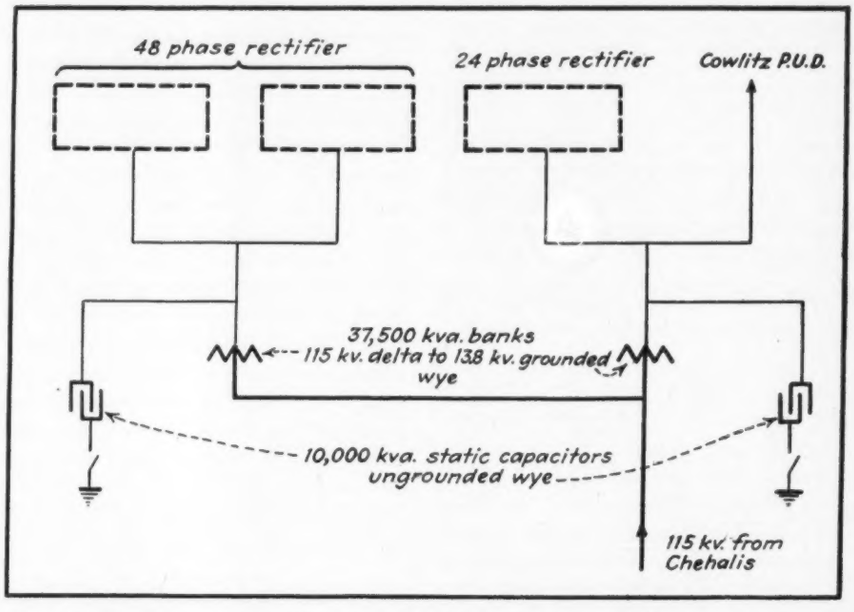

48 phase rectifier
24 phase rectifier
Cowlitz P.U.D.
37,500 kva. banks
115 kv. delta to 138 kv. grounded wye
10,000 kva. static capacitors ungrounded wye
115 kv. from Chehalis

FIG. 1—Schematic arrangement of two 10,000-kva. banks of capacitors at USBPA Longview substation

Rectifier Loads

The loads at Longview consist of 31,000 kw. to a 48-phase rectifier, 26,000 kw. to a 24-phase rectifier and 3,000 kw. to a local public utility district. Ordinarily, the problem of supplying leading rkva. in conjunction with a load of such magnitude would require either a synchronous condenser or static capacitors with enough oil circuit breakers to approximate continuity of control. Fortunately, however, the rectifier load at Longfellow is practically constant at all times, and two static capacitor banks with one oil circuit breaker for each bank have been found to be satisfactory. No operating troubles have been experienced to date.

Each capacitor bank is mounted in star with floating neutral and is connected near the secondary of a 37,500-kva., 115-kv./13.8-kv. delta/grounded-wye bank. The capacitor banks are connected electrically only through the primaries of the two banks, and the transformer reactance thus interposed between capacitor banks is sufficient to prevent excessive current inrush when one capacitor is energized with the other in operation.

Physically, the installation consists of 1,322 15-kva., 7,960-volt capacitor units arranged in two banks of 10,000 kva. each. Each bank consists of three racks, one for each phase, of wood-frame construction, surrounded by a grounded wire mesh. Each bank is mounted on pedestal insulators, and the capacitors are arranged in double rows as shown in Fig. 5. Each capacitor is connected solidly to the neutral bus on the side nearest the center of the rack and through a special indicating type capacitor fuse to the phase bus on the other side. The buses are supported by the capacitors and by the capacitor fuses. Each rack has permanently connected an inductive discharger capable of bringing the voltage across the capacitors to 50 volts in one minute or less after they are switched out.

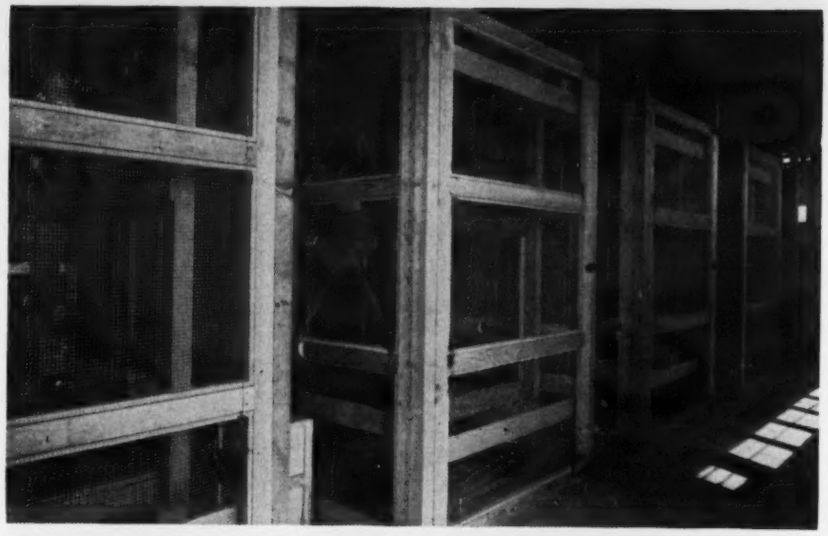


FIG. 3—Six such racks, each comprising one phase of one bank, i.e., 222 of the 15-kva. units.

Breakers and Disconnects

Each bank is connected to only one oil circuit breaker, located at opposite ends of the capacitor shed, but each bank also has disconnecting switches to permit operation of the bank at one-third, two-thirds or full capacity. The oil circuit breakers in use at present are rated at 15-kv., 2,000-amp., 1,000,000-kva. interrupting capacity. This rating is several times larger than necessary for the reason that these breakers have been temporarily removed from another station where they served to give only flexibility and added reliability of operation.

Short-circuiting and neutral-grounding switches are also provided, and these are equipped with photoelectric relays to prevent closure of the main breaker unless they are open. The photoelectric relays are not energized except when control switch is held in closed position. This introduces a short time delay in closing the breaker while the tube filaments warm up. Each bank is also protected by overcurrent, over-voltage and overcurrent ground relays. In addition, the 13.8-kv. system is protected by lightning arresters and auxiliary relays open either capacitor breaker whenever the high-side breaker of its transformer bank opens.

Ungrounded Wye

In the design stage two factors led to the choice of an ungrounded-wye installation. These were:

1. An ungrounded-wye connection will subject capacitors to less over-voltage during single- or double-phase short circuits to ground than would a grounded wye. This might not seem to be an important consideration, but during unbalanced fault conditions line-to-ground voltage may rise to twice normal line-to-neutral voltage. Therefore, with an ungrounded connection, this overvoltage is distributed across two capacitor phases in series, whereas it would appear across single phases if the neutral were grounded.

2. The breakdown of a single capacitor in the grounded-neutral scheme would constitute a single-phase fault to ground; whereas, with

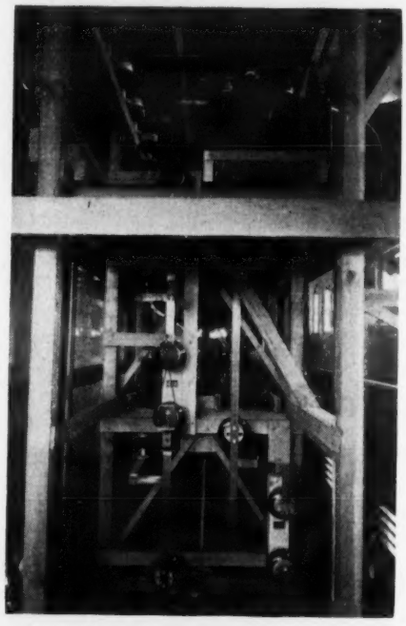


FIG. 4—Switch end of each rack; knife-switch is for short circuiting; holes drilled adjacent to it allow photoelectric beam to pass; at right are inductive dischargers (resembling potential transformers)

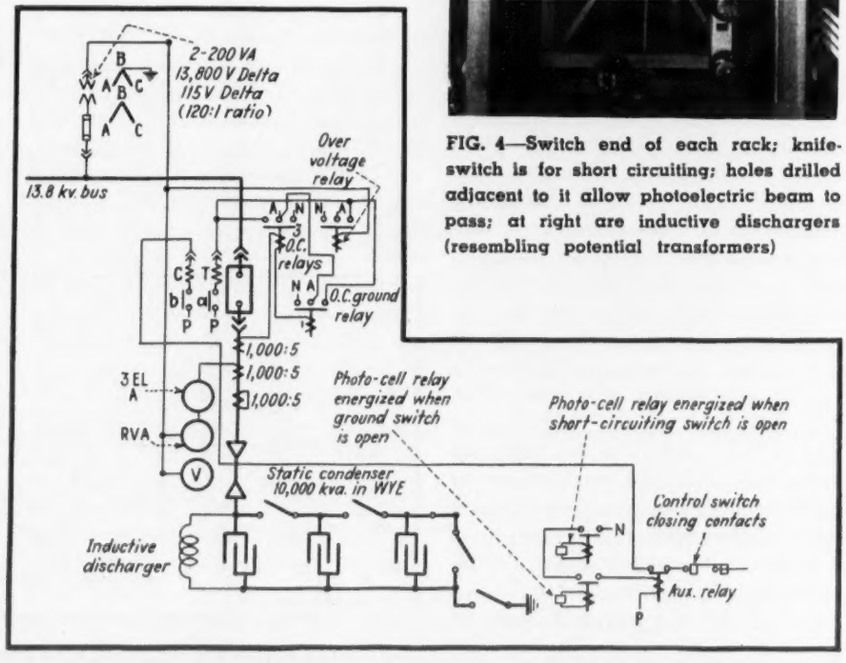


FIG. 2—Relaying and switching of each 10,000-kva. capacitor bank

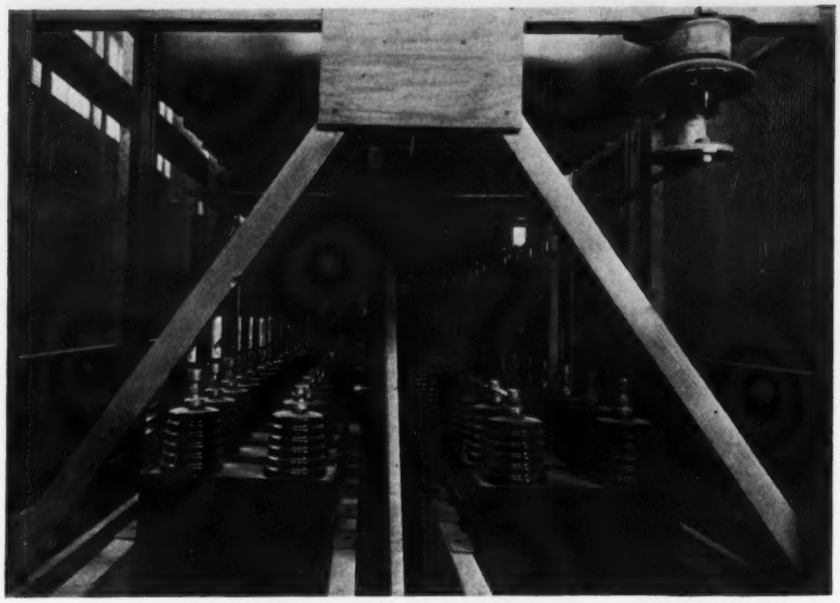


FIG. 5—Capacitors of one rack converge in perspective

an ungrounded neutral, current through a faulty capacitor is limited by the reactance in the two other phases.

Since each capacitor was to be fused individually to obtain the greatest group reliability, both of the above considerations require fuses of less interrupting capacity and permit the use of capacitors of lower voltage rating.

Like considerations also apply in favor of the ungrounded wye as opposed to a delta installation.

Harmonics Minimized

Another, though less important, factor which indicates an ungrounded neutral is the suppression of possible triple or multiple-triple harmonic currents. The danger of difficulties with harmonics in this region was well realized, and so, as soon as the capacitors were almost all installed (June, 1942), joint tests were made by the BPA and Pacific Telephone & Telegraph Company to determine the effect of the capacitors on harmonics originating in the rectifiers. Even harmonics, of course, were absent due to the nature of the electrical equipment involved, and triple or multiple-triple harmonic currents were suppressed by the absence of more than one grounded neutral. The possibility was realized, though, that some of the remaining harmonics, originating as voltages in the rectifiers, might resonate in some combination of the inductive and capacitive reactances involved.

Results of extensive testing with various amounts of capacitance and with both balanced and unbalanced rectifier operation showed that a near resonant condition, as anticipated, did exist for the eleventh harmonic with 3,330 kva. of capacitors on the 48-phase rectifier bus, but this condition disappeared with increased capacitance. The tests also showed that the telephone interference factor was reduced to about one-tenth its former value when the capacitors were connected, other conditions remaining fixed.

At present the plans for immediate system development are in a continual state of flux, since the efforts of the BPA are devoted almost entirely to delivering the most possible power with the least possible use of material. As soon as Bonneville returns to a program of normal peace-time development the Longview capacitor installation will probably be split into smaller units to be used at more remote feed points in the system and Longview will be equipped with synchronous condensers.

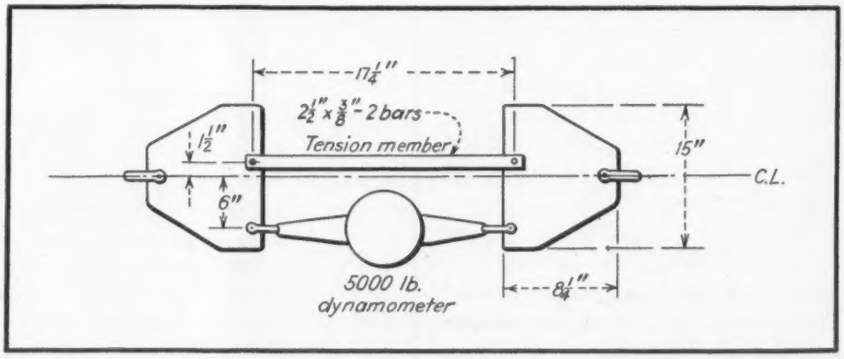
Measure 25,000 Lb. With 5,000-Lb. Scale

How a 5,000-lb. dynamometer was made to do the work of a 25,000-lb. instrument for pre-stretching conductors on a river-span section of the recently completed Omaha-Median 154-kv. transmission line interconnecting the systems of the Nebraska Power Company and the Kansas Gas & Electric Company is shown in the accompanying sketch.

Conductors of the new line were to be sagged to a tension between 20,000 and 25,000 lb. No dynamometer of this capacity was available on the Nebraska Power Company system, but a 5,000-lb. unit was at hand. To obtain the necessary 5:1 ratio an "equalizer yoke" was made up from two transmission line tension yokes and two straps made from old transformer hangers.

The dynamometer and a main tension member are offset on the yoke assembly with the lever arm of the dynamometer four times that of the tension member. For a 25,000-lb. pull, therefore, the tension member assumes 20,000 lb. and the dynamometer 5,000 lb. Readings of the dynamometer are therefore multiplied by 5 to obtain the value of total tension.

Before being put in use the assembly was calibrated accurately in a tension machine.



EQUALIZER YOKE permits 5,000-lb. dynamometer to measure 25,000-lb. stringing tension in transmission construction

How to Tell Joe and Get Joe to Tell

GEORGE W. KERR, Ebasco Services, Inc., New York, N. Y.

JOE BOYD, one of the men that works in the electric company, on his way home the other night met Mr. Watkins, prominent and influential citizen of the community. "Evening, Joe," said Mr. Watkins. Joe responded and expected to pass on, but Mr. Watkins stopped him, saying, "Say, I got your company's annual report this morning and I see they say so and so, etc. What do they mean by that?" Well, poor Joe, he didn't even know they had sent out a report, let alone have a look at it. He didn't want to be disloyal and bite the hand that feeds him by taking a backhanded swipe at the top boys by saying, "I'm not a stockholder, Mr. Watkins, so I didn't see the report, and about what you asked me, why, they don't take up such matters with the likes of me."

On the other hand, he didn't want to appear dumb in the eyes of Mr. Watkins, who evidently expected him to know the answer to his inquiry. So Joe shifted from one foot to the other and took a flying jump at what he guessed might be the right answer. Maybe it was right. Maybe it wasn't!

He either did that, or said, "I wouldn't know about that, Mr. Watkins. It's not in my department."

Some companies do not send every employee a report for some such good (?) reason as expounded by one vice-president and general manager: "Why, our report shows operating revenues of over 13 million dollars. I believe it's as dangerous to put 13 million dollars in an employee's mouth as in his hands!"

Does This Shoe Fit?

But suppose you say, "Oh, we have no objection to our employees seeing our report. All they have to do is ask for it." Are they going to ask for it? They are not. They wouldn't dare. Suppose one of them did get up nerve enough to ask for the report. Where would he go to ask for it? If he had the audacity to stick his nose in the treasurer's office and ask for a copy of the annual report they'd probably grab him and bundle him off to a psychopathic ward for observation! Maybe he'd screw up his courage to ask his department head for one. But he'd probably back down at the last minute for fear he'd bump into something like this: "ANNUAL REPORT!!? What do YOU want with an annual report? Want to do some snooping into affairs that don't concern you?"

Does This Shoe Fit?

Maybe you do send a report to every employee.

Just giving reports to employees and letting it go at that is taking only a little nibble at a golden opportunity to do a grand public relations job.

To obtain the fullest advantage of putting reports in employees' hands, see to it that they can discuss and interpret the report with intelligence and understanding. A good way to take the first step in this direction is to mail the reports to the employees at their home addresses—and accompany the report with a brief letter from the president of the company. Of course, the letters should be addressed individually to each recipient. Don't send out one of those "To all Employees" things.

What will you say in the letter? What will be your approach?

Are you going to divulge your real motive—that you want to equip them to fight your battles? Well, of course, that's not so bad. Your battles are their battles. To an extent, they are.

But there's a better approach.

It is for the personal benefit of each employee that you are sending the reports to them. Say you realize that from time to time their friends and acquaintances bring up questions which embarrass employees because they don't know the answers. Say you are putting the report in their hands as the first step in a program to enable them to discuss the company and its affairs intelligently, unhesitatingly and satisfactorily.

Now comes the important part of the letter. Invite questions and comments. Ask for questions not only about the report but also about the company, its policies and its affairs in general. You will find there are quite a few things which employees would like to know, things they feel it is their right to know, but which they will not ask for fear it might "back up" on them. So request specifically that they do not sign their names to their lists of questions, thereby leaving the way open for them to be quite fearless and frank. Conclude the letter by saying the questions will be answered at open forum meetings to be held throughout the organization in the near future.

Be sure to inclose with your letter an addressed postage prepaid envelope to use in sending the list of questions to you. Don't ask them to bring their questions to the office and deposit them in a box or something.

Understandable Language

It is a good idea to have a sort of "editorial" committee of about three or five people to handle the lists of questions and comments. To each there is always one best answer or explanation, to arrive at which is the committee's job. After they are written out call in your advertising man (if he is not already on the committee) and get him to put them in language people can understand. You will find that the questions and comments can all be grouped under a few general headings. Then have the whole thing printed and made up into a convenient pocket-size booklet and give one to each employee at the "open-forum" meeting.

Even though accompanied by a letter from the president, to pass out the reports by hand during business hours is bad. Employees won't want to read them when they ought to be working and there's a good chance they will not take them home, which is the place to read the report properly. But of greater importance is that if you mail them to the home address they are quite likely to come to the attention of the womenfolks of the employee's family. They're the ones to get mixed up in this thing as much as the employees themselves. "I can tell you a few good ones to send in" will come from nearly every one of them.

Automatic Air-Breaks in Lieu of Oil Breakers

Progressive installations range from 11 to 110 kv.— Faults cleared successfully — Promotes simplification of substation equipment and layout

A. M. McCABE, Substation Engineer, Carolina Power & Light Company, Raleigh, N. C.

FOR ECONOMY it is advantageous under certain conditions to use motor- or spring-operated air-break switches with relays or other automatic tripping devices in place of oil circuit breakers having an installed cost of two to eight times that of the air-break switches. The present material situation is a further incentive for the use of air-breaks in place of breakers at new locations, and for the substitution of air-breaks for existing breakers at locations where air-breaks will suffice, in order to avoid the purchase of breakers for new locations where breakers are essential.

About 1924 the Carolina Power & Light Company made a trial installation of an automatic air-break switch on the 22-kv. incoming side of an industrial substation of 2,500-kva. capacity in place of the former non-automatic air-break switch and fuses. It consisted of a side-opening air-break with more than ordinary phase spacing, latched closed against a spring-opening mechanism. A trip coil connected to a battery and to a 22-kv. series relay tripped the latch on over-current.

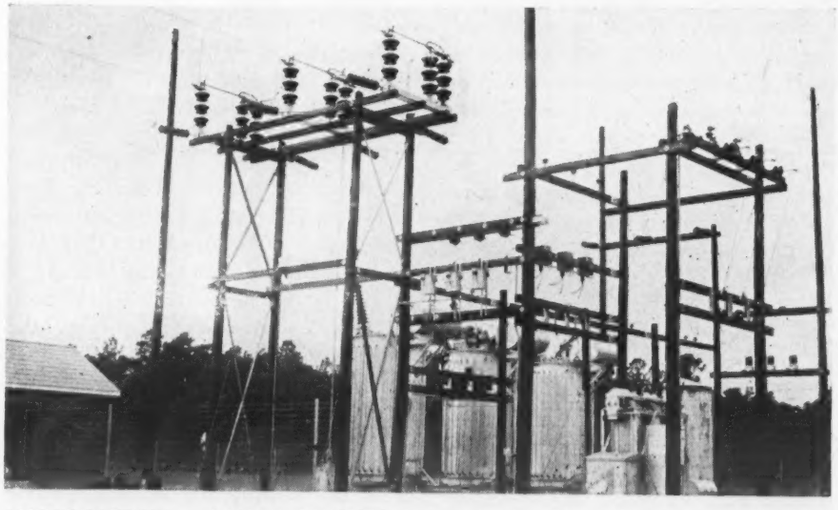
Time Relay Added

Installation of this automatic air-break was prompted by unsatisfactory operation of high-voltage fuses of larger than 100 amp capacity, expense of dispatching men to replace fuses and lengthy interruptions while men were located and traveled to the station. It was found to function satisfactorily, except that it had no time delay feature, which was remedied by inserting a definite time-delay relay in the trip circuit. Arrangements were made for the customer to reclose the automatic air-break when it tripped and thus reduce the length of outages and the time and traveling expenses of company workmen.

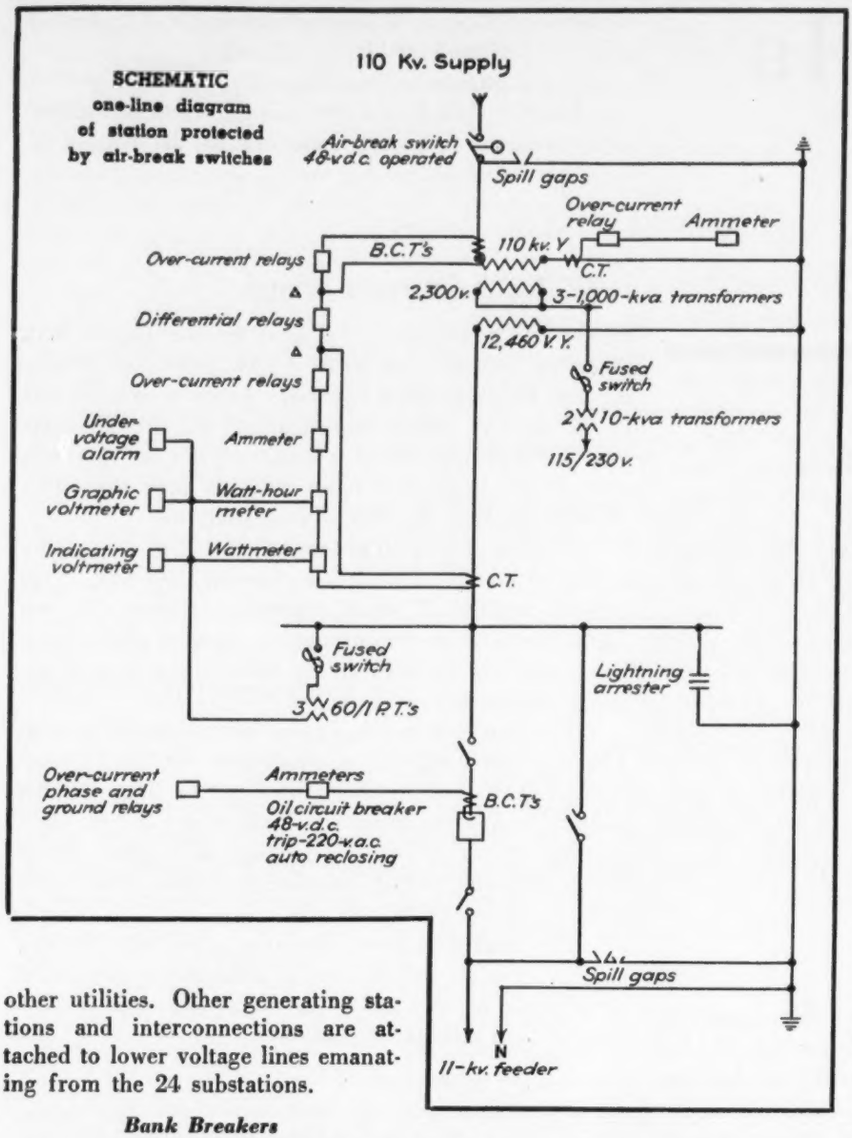
The company now has three 11-kv., fifteen 22-kv. and six 66-kv. automatic air-breaks on installation similar to the foregoing and has never had a serious failure on any of these switches. Later models have been equipped with low-cost current transformers and induction overcurrent relays in place of the early series relays. It has been found that they can be depended upon about as well as oil circuit-breakers to trip when required. In a majority of operations they clear the faulty station without interrupting the line to which connected, but they sometimes flash to ground or between phases and cause line outages particularly at certain locations and during high winds. While these line trip-outs interrupt all customers on the line, the outages are of short duration and cause little inconvenience to customers.

On some lines on which there are customers whose manufacturing processes are upset by short outages, the length of outages has been reduced sufficiently to provide satisfactory service by installing fast-reclosing equipment on the line breakers. Early 66-kv. automatic air-breaks were spring-operated, but it was found difficult to keep them in operating adjustment, and the spring mechanisms have been superseded by motor mechanisms. On the 22- and 11-kv. air-break spring mechanisms are satisfactory and preferable to motor mechanisms on account of speed of operation.

The backbone of the company's transmission system consists of approximately 1,000 miles of 110-kv. lines, to which are connected four generating stations, 24 substations and fourteen interconnections with



MOTOR-OPERATED AIR-BREAK SWITCHES on incoming 110-kv. line actuated by overcurrent or differential relays



other utilities. Other generating stations and interconnections are attached to lower voltage lines emanating from the 24 substations.

Bank Breakers

During 1930 an additional substation of relatively small capacity was needed with automatic features which would not require full-time operators and it was desired to have the station draw power from either circuit of a double-circuit 110-kv. line. From consideration of the infrequent operation of bank breakers at other stations, the lack of sufficient load on the new station to justify heavy expenditures for breakers and the satisfactory performances of 22- and 66-kv. automatic air-break switches, it was decided to install automatic air-breaks on the 110-kv. side of the transformer bank instead of breakers.

Two motor-operated air-breaks, with sturdy arcing horns and 14-ft. phase spacing, were installed to tap the two 110-kv. circuits and the transformer bank was connected between the two switches. One switch is normally open, but when voltage fails on the line to which the transformers are connected the switch connected to that line automatically opens and the switch on the other line closes. In event of no voltage on either line, this change-over operation ceases after three trials. Overcurrent and differential relays connected to bushing current transformers in the power bank open the air-breaks in the event of station trouble or failure of the low-tension feeder breakers.

Faults Cleared

Manufacturers were reluctant to offer interrupting capacity ratings for the air-breaks due to variable conditions under which they might be operated. Staged tests demonstrated that they would handle considerable fault current under conditions prevailing at the time of the tests, but the arcs hung on until the switches were practically fully open, which was about three seconds. To date these switches have opened to clear faults on several occasions without damage to themselves and usually without causing the 110-kv. lines to relay out.

The performance of the air-breaks at the foregoing station paved the way for their use at other new stations, and eventually for their use to release existing bank breakers from some of the older stations for installation on new line positions in lieu of the purchase of new breakers. At present the company has automatic air-breaks on the 110-kv. sides of transformer banks ranging from 3,000 to 12,000 kva. at nine of its 24 110-kv. substations. To date their operation is considered to have been entirely satisfactory. It is realized that air-breaks have certain shortcomings and their performance does not approach that of oil circuit breakers in speed or sureness of interruption, but the great difference in cost justifies taking some service risk at carefully selected points where interruptions are infrequent.

Station Simplified

A recently constructed small station (see accompanying illustration) has a motor-operated air-break switch on the incoming 110-kv. side. The motor mechanism opens the air-break when actuated by overcurrent or differential relays. The air-break at this station is supported by wood timbers, but steel arms would have been used if steel had been readily available, as the smoothness with which an air-break operates is dependent largely on maintaining a fixed relationship in the location of its parts. The wood timbers are likely to warp and it may become necessary to readjust the switch-operating mechanism from time to time.

The tall poles support shielding ground wires, which extend for several spans over the incoming 110-kv. tap line, and grounded arcing gaps at the rear end of the 110-kv. air-break limit the voltage to ground. There is ample space for additional 11-kv. feeders and for a step-voltage regulator. If this station had been built prior to 1925 it would have had a 115-kv. oil circuit-breaker with bypass and disconnecting switches, latticed steel switch structures, a spur railroad track, transformer transfer car, brick-inclosed transformer hoist tower and repair building, and an operator's cottage.

Editorials

S. B. WILLIAMS, *Editor*

Red Tape Does Not Interfere With Emergency Supplies

LAST WEEK'S Eastern sleet storm gave WPB Power Division its first real test for taking care of supplies for emergency repairs and, according to all the field reports, there was no delay. One of the big worries of the utility industry has been the fear that load would be down longer than need be while Washington unraveled the red tape.

It is to be hoped that any companies that have been unsympathetic to the program of drastic inventory reduction for that very reason will have less hesitancy in sharing their inventory with others. WPB has proved that it can act speedily and effectively in an emergency.

More Food from Power

SHORTAGE OF FOOD, particularly dairy products, accentuated by a decreasing farm labor supply, has brought farm electrification extension back into the limelight as a means of relief. WPB has been told by the farm-food people, with support from the Manpower Commission, that the war effort would be quickly helped if some way could be found to release material for extensions to present lines where it could be shown that food production would be increased greatly. Some such plan is now being formulated and can be expected to be made effective shortly.

So far the suggestion and deliberations have been entirely on a non-partisan basis of assisting in a farm-food problem, although there are those who would prostitute the program by grabbing the credit to turn it into a public power promotional program.

So far WPB has rightly stayed away from the public-versus-private power controversy. Nothing could jeopardize this farm-food program quicker and thereby help the enemy than to turn any priority assistance into an ownership propaganda campaign.

We hope that WPB is smart enough to place such limitations on these extensions that they will be used solely for the intended purpose. It has been intimated that the lighting of farm homes may be included, because farm opinion will demand it. We suggest that if there is enough copper to wire farm homes and appliances to furnish them, there is also a drastic shortage of household help elsewhere which might be relieved.

This is no time to temporize with selfishness, and we hope that the WPB Power Division will continue to show the courageous judgment demanded by the realism of the moment.

1942 Peak Output Week

LESS THAN twenty-five million kilowatt-hours were needed to send the peak week of 1942 power output into the four billion bracket. If for any happy reason the war should be over before next summer, this pre-Christmas week's output may stay as a mark to shoot at for a long time. It was more than twice the 1929 peak week and, incidentally, that stood for a long time, too.

There is nothing in the curve as yet to give any indications of possible 1943 trends. Because, however, of the extreme rapidity of output expansion in one or two regions, we shall probably have to examine each region more carefully to catch trends before they become apparent nationally.

The past year's curve resembles very closely both 1935 and 1940, with the one exception that until Christmas week the holiday drops were not so sharp. If that statistic means anything, we could expect a less rapid increase with a pronounced leveling off in 1944. All of which, of course, is rank speculation because of the dominating influence of the war.

The reassuring thing, of course, is the fact that there is nothing in the output curve to indicate any embarrassment to the utilities in serving the nation's war requirements—both civilian and military.

Unity of Safety is Constructive

FEARS have been expressed that to attempt to arrive at unity of safety is but another effort to tear down present safety standards as expressed in various construction codes. Nothing could be farther from the facts. On the other hand, if an accepted unit of safety should indicate factors of safety that are less restrictive than present codes or practices it would be folly to try to protect methods that are wasteful of money, materials and labor.

The study to determine unity of safety which has been suggested in these columns might in certain instances result in less restrictive practices, while it might in other instances bring just the opposite. The point is that whatever results, it will be based upon knowledge and not on suspicion and ignorance.

It is our opinion that there are certain base conditions that constitute unity of safety from which factors of safety that represent minimum standards of good and reasonable practice may be derived. The factors of safety, on the other hand, will be based upon experience and may differ for materials, methods, occupancies, geographical location, loading or utilization. Furthermore, factors of

safety may change as experience dictates. The base, however, remains fixed.

When we come to applying factors of safety, we must be careful not to let our judgment be ruled by too little experience. In safety, like everything else, the element of reasonableness must be ever present. It is never going to be possible to so build electrical devices, lines or circuits that they will never have an accident to equipment or person. On the other hand, reasonable safety doesn't mean guarding against average conditions, but something that occurs much less frequently. It means that occurrences should have known frequency and severity in order to determine how far to go in protection. For instance, we can build against certain ice storms, but it would be folly to try to build against a hurricane that might come once in a hundred years.

This effort to determine unity of safety is designed to replace guess and compromise with something that is a little more safe.

Public Opinion and the Brown-out

REGARDLESS of the fact that there is no generating capacity shortage, that utilities have more than ample coal stocks, that water conditions generally are favorable and that any savings of fuel or transportation resulting from a ban on non-essential exterior lighting would be small indeed, a modified dimout or brown-out will become nation-wide shortly, primarily because of public opinion.

When the public has trouble keeping warm at home it doesn't take kindly to the use of any kind of fuel for decorative or advertising lighting. Moreover, a blaze of light downtown at night to a great many people, both within and without the power industry, doesn't look like the right attiude toward the war effort. The public doesn't know that the power companies cannot cut customers down or off without an order from some government body, with the result that public opinion reacts unfavorably toward the suppliers as well as the users.

Of course, much of the load so lost is a better than average revenue producer, but even so it is not so large as to warrant a tussle with public opinion. It should be considered a war casualty just as much as though there were shortages that demanded this sacrifice.

Fortunately, the order is not expected to interfere with lighting used for public safety. This is sensible, but will the public understand why? Even when dimout lighting was applied to the two coasts for reasons of naval necessity, it appeared to be difficult to secure compliance readily.

A lot of public education is necessary, and if left to civilian voluntary bodies it can be badly mismanaged. Regardless of what any one else does, the utilities will find that they will have to do the job of public education, if for no other reason than to protect themselves. Many headaches will be averted if the decision is made to engage in such work at the very start instead of waiting.

WPB, we assume, will make the facts available to the industry before the order goes through. The more consistent and reasonable the story over the nation, the better should be the compliance.

Jurisdiction in Renegotiation

HAS the Federal Power Commission jurisdiction to renegotiate power contracts previously approved by state regulatory bodies? The question may come up in the Arkansas aluminum case now being considered.

The Arkansas commission, in petitioning to intervene, pointed out that it had approved the rate after study and indicated all the things it had considered before giving its approval, even to the competitive aspects involved in the co-op Ark-La service. FPC has permitted the Arkansas commission to intervene, but does not recognize it as one that might be aggrieved by any order issued in the proceedings.

Does the holding of hearing by FPC in such cases imply that it has the power of review of state commission decisions on purely intrastate matters? What difference does it make that the government happened to be the customer? The government has been getting increasingly careless with state lines, but this seems particularly audacious.

FPC believes it has jurisdiction because of power delegated to it by the President under his war emergency powers. How far can these powers interfer with normal regulatory processes without proving impedance to the war program?

Do these emergency powers extend to the point of permitting arbitrary reductions regardless of the effect upon other customers and, if not, then how can the government escape the charge that it in effect is trying not the suppliers of power but the state commission that authorized the rate?

In the Arkansas contract not only was there affirmatory action by the state commission but there was arm's length bargaining with every interested Washington agency, and all with abundant publicity. If ever a rate was scrutinized forward and backward and inside out, it was this one.

The whole proceeding is so different from that in other renegotiation cases that one wonders if perhaps the government may not be motivated by something more than arriving at a proper rate. When the government renegotiates a contract with an unregulated manufacturer, are there any such field days as have been taking place at Little Rock?

Perhaps, though, in a test case where so many questions arise it is necessary to have a thorough airing. Such a course will be justified if out of it comes a clarification not only of the relationship between government and state regulation but of the contractual relationship between power suppliers and war contractors or government purchasing agencies.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Rural Extensions to Be Eased to Provide More Food

MANPOWER SHORTAGES on the nation's farms in the midst of a Government-promoted drive to increase food production is forcing a reconsideration of WPB's year-old ban on rural electric extensions.

The Department of Agriculture reopened the issue with the War Production Board while the 1943 farm production "goals" of various crops and foods were in preparation some weeks ago. Subsequent studies of the critical materials "cost" of such a program and evaluation of potential benefits in terms of milk, eggs, meats, etc., appear likely now to be resolved into a formal policy rather soon.

No promiscuous Government-financed program of rural lines is in the cards. Instead, WPB probably will simply relax its Order P-46 prohibition of all utility extensions to permit electrification of certain farms now beyond the reach of distribution systems.

Annual Unit Plan

The procedure being considered is one which authorizes extensions of varying distances depending upon the productivity potential of the farm. The Agriculture Department people have an ingenious "animal unit" table for rating farms—one cow equals one animal unit and other livestock and crops, in varying quantities, are considered to equal one cow, or animal unit. Thus this forthcoming rural extension program might authorize, for example, a 500-foot primary line extension to serve a farm rated as 10 units and a mile-long extension to a farm of 100 units.

"Whisker" extensions, they are called. The idea is that, for the most part, the lines would reach down side roads to carry energy from existing primaries to the farm over the hill. No one to date who has had a hand in formulating the policy has talked in terms of erecting whole new distribution systems.

The program in the making will be open to public and private utilities and cooperatives on the same basis. If made effective by the change in P-46 method, the easiest way inasmuch as all operating systems are subject to that order, the amendment doubtless would grant a blanket authorization to utilities and co-ops to build lines of specified lengths to farms with the prerequisite number of animal units.

County Board Certification

Certification of eligibility of farms to receive service probably would be a job for the County War Boards, which now handle service applications for WPB in cases involving new farm buildings.

The amount of materials required for this undertaking is generally conceded to be relatively small and for the most part equipment which is already on hand in greater quantity than is needed under present wartime restrictions. Thus, it is expected that pole line hardware, distribution transformers, meters and the like could come from present stocks. So, too, could copper conductor for service drops. It is planned that primary lines would be restricted to steel wire, probably the only item which would have to be provided in any quantity.

Farm appliances, such as milkers, coolers and pumps, are available, also, in some quantity, although no more are being manufactured and the extension program contemplated probably would not warrant additional production.

There is, of course, the question of wiring the farm house for lighting and whatever domestic appliances could be obtained. Originally there was some talk of not lifting the ban on home wiring, saying in effect: This is a man-hours conservation program and service is being provided to assure the supply of milk and butter and eggs, not for personal convenience. But it won't work out that way! It's recognized that a good many farmers—and farmers' wives—would raise a rumpus about it.

Is there any real justification for a rural extension program in wartime? Or is this a pressure campaign by the public power crowd? It's an inevitable question.

Up to now, it seems apparent that the issue has been considered almost exclusively for what it is—a farm problem and not a power problem. This may not last. Taking advantage of the knowledge that the issue has been getting active re-study, ex-Congressman Clyde T. Ellis' National Rural Electric Co-operatives Assn. is going to turn on the heat with its first formal meeting dedicated to the theme song of "Power for Food."

Food the Issue

As a farm problem, the issue is simply one of whether the expenditure of a certain amount of critical materials will bring a return in terms of foodstuffs sufficient to warrant their use. Even within WPB itself there are those who always have considered as too harsh the complete shutoff of rural lines which grew out of the acrimonious showdown with the Rural Electrification Administration just before Pearl Harbor.

There is no way, of course, to chart specifically what electrification of a dairy farm will mean in the way of milk production. It isn't like the conversion of an auto factory to the making of tanks and planes, where the result is visual.

Justification for a "whisker" extension program without the muddying effect of power rivalry follows somewhat along this line. There is an acute shortage of farm hands. There has been—and will be more—slaughtering of dairy herds which couldn't be cared for. Electricity is a potential substitute for man-hours and while there is no certainty that the farm which gets electric power is the same one which can't get manpower, in the aggregate electrification is bound to help.

It is on that basis that the program has gotten where it is now!

NEWS OF THE WEEK

Floods, Ice, Tie Up Power Lines in East

Three-day assault brings near-record high water and ice conditions to large area — WPB's emergency excess inventory control works smoothly in helping restore service

Near-record floods, accompanied by ice and sleet conditions, caused inestimable damage and loss of thousands of man-hours of work in war plants throughout the industrial East over the New Year, bringing in their wake virtual paralysis of transportation, communication and power facilities in many areas. The relentless three-day assault extended from upper New York State, through Connecticut and Massachusetts to the turbulent waters of the Ohio River, which lapped over the same cities of Pittsburgh, Youngstown, Wheeling and nearby communities that still remembered the fury of the 1936 disaster.

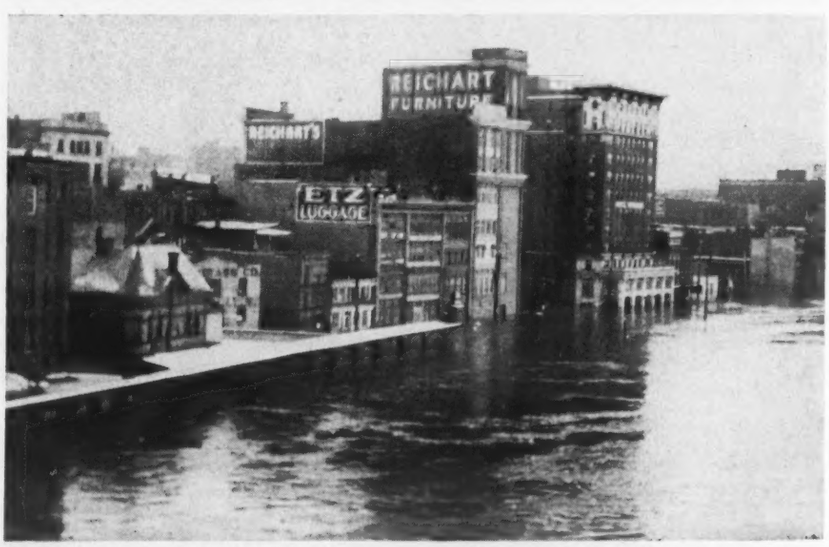
WPB Order Works

Emergency crews, linemen and maintenance engineers of power companies worked night and day to restore service to stricken towns and cities and, for the first time since the War Production Board's P-46 order on excess stocks of utility maintenance material went into effect, it was proved, under the emergency clauses of the order, that the transfer of essential material such as wire and cable and pole-line hardware can be speeded up to meet such conditions. Despite allocations of existing stocks and the fact that utility officials, working under pressure, obviously could not shop around to fill their requirements, WPB's order worked smoothly in getting supplies to the affected areas.

In New England, for instance, two appeals were made to the WPB for help in getting the necessary replacement supplies. One company had excess stocks in inventory and wanted permission to use them in excess of P-46 limits. Permission was granted. Another company (Connecticut Light & Power) had 3,500 pounds of wire on hand when the sleet storm began bringing down the wires and quickly found its supply diminished to less than 1,000 pounds. Contact with WPB officials brought immediate action for an emergency allocation of 10,000 pounds of wire from the Anaconda plant at Hastings, N. Y. Under the emergency clause of the order permitting utilities to accept delivery in case of fire, flood, storm, etc., the P-46 order merely requires that the companies report later how much they exceeded P-46 limits and the reason. Advance explanations are unnecessary.

That the priority formalities can be accelerated when emergencies confront the utilities was demonstrated by the experience of Connecticut Light & Power Co. in the ice storm which devastated wire lines in western Connecticut for several days beginning on December 30, 1942. Glaze up to 4 inches diameter on the wires and similar formations on trees pulled down miles of wire in numerous segregated areas at above 400 feet elevation.

Frank Reinhold, assistant purchasing agent and chairman of the company's priority committee, got into action at 4 a.m. and, finding from local officials that Anaconda had a stock of No. 6 wire, made a commitment for 10,000 pounds subject to authorization by WPB. Similar discovery and commitment was made with the Graybar representative regarding 5,000 each of splices and connectors. At 9 a.m. a call to the WPB power group and the WPB copper branch brought shortly the desired authorizations after it was made clear that the utility's stock of 14,000 pounds of No. 6, reported on September 1, had



WHEELING UNDER WATER—The near-record flood of the New Year brought the waterfront section of Wheeling, W. Va., 10 ft. under water by January 1

BOND DRIVE FLOAT—A few touches added to a Toledo Edison truck crane turned it into this interesting motorized "field gun" for a recent Toledo bond drive. Some sections of steel light fixtures make a very realistic gun

been almost completely expended in authorized extensions and projects and immediate absorption by the emergency crews. The splices and connectors arrived by truck before noon and the weatherproof wire arrived from Hastings-on-Hudson late in the evening.

This emergency material, in conjunction with forces shifted from unaffected areas, help from two other agencies and an effective radio communication system, enabled a quick restoration of major services. A. L. Pierce, general manager of the Wallingford Borough Electric Works, offered a gang which was set to work in Bristol. A crew of the Electric and Telephone Line Construction Co. of Germantown, Pa., was in the territory and assigned to reconstruction operations in Winsted, a seriously affected community. The radio is a two-way Link F-M installation at five major stations with an equipped car and two portable units that can be set up in critical areas. Its effectiveness in this instance confirmed the contribution made on one or two similar emergencies when customary communications failed.

One resident of Winsted, Henry Weber, a former company lineman, was enjoying a day off from his new work at New Departure Manufacturing Co. in Bristol and volunteered his services for line work in his home town. In fact, New Departure officials were so impressed with the urgency of restoring electric service to the many war industries of the area that they let him stay on his old line-gang job for a week to finish the clean-up, much as they wanted his services themselves.

Upper New York Hit

In upper New York State, through the Schoharie and Cherry valleys, officials of the New York Power & Light Corp. said the sleet conditions created "one of the worst conditions we ever had in the territory." Johnstown, Gloversville, Cobleskill, Middleburg and Van Hornesville were the worst areas. Fortunately the Schenectady, Troy and Albany areas suffered comparatively little so that it was possible for the company to bring in crews from those districts.

Transmission Lines Buckle

Four cases of transmission line trouble were experienced. A part of the 110,000-volt line running across the state, for instance, in the vicinity of Dolgeville had eight steel towers buckle over with the weight of ice on them. Difficulty in repairing wires and restoring towers for the high transmission wires was accentuated by heavy rains which kept up for four days. In some cases repair crews were disheartened by high winds which ripped out ice-laden lines repaired only the day previous. The New York Telephone Co. estimated that between 2,500 and 3,000 poles were down in this region alone.

Canadian Imports Lost

New York lost Canadian imports at Messina when the 110,000-volt line went out. There was no load dropped because of lack of capacity, however, it was reported, which in an area considered one of the tightest in the country is counted a remarkable achievement on the part of the utilities. Put into effect were emergency arrangements which had previously been worked out in an informal way by the companies and WPB power division. The Associated and Niagara Hudson systems were virtually "merged"; 30,000 kw. was pumped in from eastern Pennsylvania; western Pennsylvania took 6,000 kw. through sectionalization of part of the New York load onto the Pennsylvania lines. At Messina voltage dropped to the point where it was inadvisable to carry the pot lines; none were taken out, however. Instead, they rotated energy to the pot lines, keeping one pot off the line at all times, but never long enough for the pot to freeze.

In the Ohio River valley area the flood routed 50,000 people from their homes, shut war plants and crested at 60.9 feet—a little over a foot shy of the top of the 62-foot dyke at Portsmouth. Communities between Portsmouth and Cincinnati, however, were all flooded. Industrial plants in the Pittsburgh and Wheeling areas were badly hit, but production was restored after day and night operations. At the East Pittsburgh works of Westinghouse, as an example, the company reported it was operating at 90 percent of effectiveness after the waters began to recede.

Distribution Circuits Hit

In central New England the brunt of the storm was borne by the Western Massachusetts Companies, New England Power Company and Public Service of New Hampshire systems, interruptions of distribution circuits in rural areas and some twoscore small towns being largely due to falling tree limbs overladen with ice. Transmission lines from 66 kv. up suffered little damage, and in a few cases of 66-kv. interruption alternate line facilities met the situation well. In New England Power's central area about 50,000 retail customers were cut off the first day, or less than one-third of the total in the region. By the next day more than 40,000 had been restored and on the third day all but about 3,500 were getting service.

The larger war material plants of the area in general maintained production with practically uninterrupted power supply, utility substations being alive and in normal operating condition with almost no exceptions. Physical damage to these systems was relatively small; steel towers remained intact, and few wooden poles were lost, although crossarm failures were numerous on distribution systems due to falling trees or limbs. The 110-kv. and 220-kv. transmissions came through with flying colors. Boston Edison reported only nominal interruptions of service, these being caused by lines swinging against trees in wind and rain. The sleet-thawing routines of New England Power were utilized actively for two to three days west of Millbury and in the Berkshire area with excellent results. Considerable aid was effected by outside line crews rushed into the storm area. Public Service of New Hampshire reported more than 99 percent of its customers receiving service on Monday of this week, with considerable ice remaining on trees in outlying areas. Loss of load was not great in central New England in view of the extent of rural lines out.

Revise Insulated Wire Cable Orders

Specifications covering the manufacture of insulated wire and cable and regulations limiting their use have been revised by WPB in a general reissue of the rubber control orders M-15-b and M-15-b-1. Changes in the insulated rubber regulation, known as List 27, are relatively slight.

The three grades of insulation compound and single type of jacket previously specified (ELECTRICAL WORLD, July 25, 1942, page 79) are retained in the revised regulation, to which is now added two new jacket classifications using synthetic rubbers. These are W-SN-6 (Chloroprene) and W-SB-4 (Butadiene). The chloroprene type is allowed 65 percent synthetic rubber by volume, the latter 75 percent. Regular W-D jackets are limited to 50 percent crude rubber by volume.

Of the insulations, type W-A is allowed 55 percent crude rubber, W-B 35 percent and W-C 8 percent. In all cases synthetic rubber may be substituted for crude provided the total volume content does not exceed, respectively, 65, 50 and 50 percent. The specifications do not apply to listed types of military orders, to submarine, oil and gas well logging cable, to military field communication wire, searchlight, floodlight and fire control cable or to radar detector cable.

The regulation is unchanged as regards the type of outer covering, insulation and jacket permitted for various types of electrical service except that the use of either of the two new classes of jackets is permitted for portable heavy duty service. Building wire in dry locations, for example, must be covered with W-C insulation for service up to 5,000 volts with lead covering. Where a fibrous outer covering is used the W-B insulation is permitted above 3,000 volts and the W-B insulation is permitted for all uses over 5,000 volts. W-A insulation is allowed with a fibrous outer covering for all use in wet locations.

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Cut Fuse Sales Further

Manufacturers will be prohibited from selling electric fuses on orders rated lower than A-1-j after January 21 under an amendment to Limitation Order L-161 which seeks to improve WPB's control over fuse distribution at jobber and wholesale levels.

The amendment will not affect retail sales to small consumers. Until January 21 fuses may be sold on A-10 ratings.

Maintenance, Repairmen Ruled Essential Workers

Electricians, motor repairmen, welders, appliance and radio repairmen included in listing as warranting occupational deferment, if capable of all-around repair service

Electricians, motor repairmen and appliance servicemen are performing services essential to support of the war effort, War Manpower Commission has ruled. As a result, men engaged in these and other similar occupations listed in Selective Service Bulletin No. 42 should be considered for occupational deferment by their local draft boards.

Cite Qualifications

Deferment consideration should be given only those workers capable of all-around repair services and then only to the extent and number required to meet minimum essential needs of the community, Selective Service warns. These criteria also govern individual deferments for workers in essential activities:

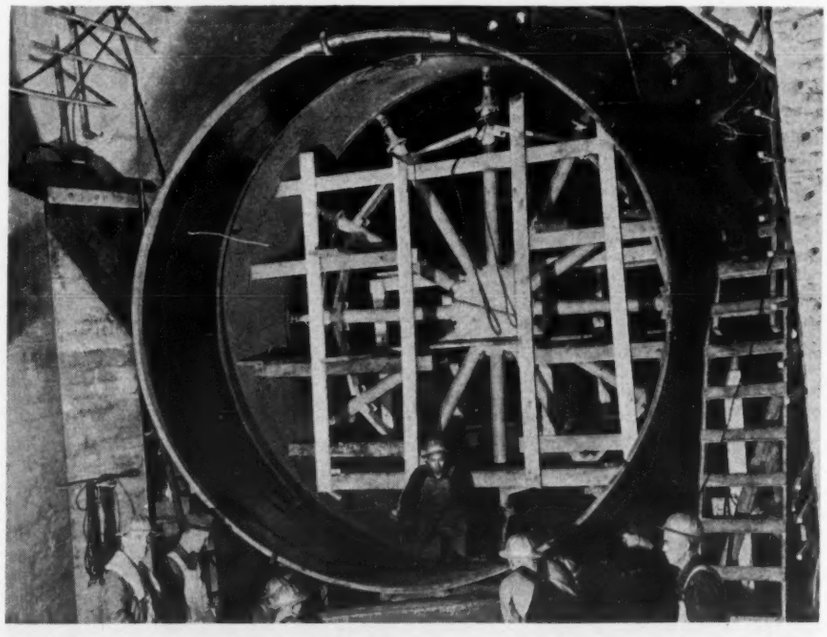
1. Training, qualifications and skill of registrant to engage in the occupation.

2. Training, qualification or skill required for proper discharge of duties.

3. Availability of persons with the same qualifications or skills or who can be trained to replace the registrant and the time in which such replacement can be made.

Included in the list, which is limited to occupations requiring six or more months training, are these occupations: Electric appliance serviceman; electric motor repairman; electrician (all around); automotive electrician; elevator repairman; foreman (engaged in supervisory duties in connection with repair services as described); furnace installer and repairman; gas appliance serviceman; machinist (all around); maintenance mechanic (all around); office and business machine serviceman; oil burner installation and serviceman; radio repairman; refrigerator repairman; tabulating machine serviceman; time recording equipment serviceman and welder (all around).

Occupational Bulletin No. 9, which defines essential occupations in electric utility operations, is due to be reissued within several weeks. The original bulletin, issued last spring, contained 86 occupations. That list has been condensed by WMC's technical committee.



INSTALLING PIPE AT GRAND COULEE—Bureau of Reclamation workmen install a section of inlet pipe, 15 ft. in diameter, that will help feed water to the turbine of a new 75,000-kw. generator at Grand Coulee. Within the next year and a half two 75,000-kw. generators and three of 108,000 kw. capacity will be added to the battery of three 108,000-kw. units now in service

Hartford Has Post-War Appliance Purchase Plan

Advance savings, on installment basis, invested in war bonds through bank, on future delivery through regular dealer channels, announced as features of proposal

Hartford (Conn.) Electric Light Co. has announced a plan making it possible for its customers to place advance orders for electric refrigerators, ranges and water heaters, and thus get in line for early deliveries on attractive terms after the war. Present investment of the customer's payments under this plan in government bonds is contemplated to assist the war effort and combat inflation.

Replacement Needs Noted

The company's announcement points out that present shortages of labor and materials make it difficult if not impossible for customers to obtain such articles. Old equipment is wearing out and must be replaced. New homes are needing large amounts of such equipment and new designs based on war production developments will outmode much present apparatus. After the war the public will have many needs, all of which must be satisfied when production again becomes possible for civilian use. It is through advance saving and orderly planning as contemplated under this program that customers will be able to apply present earnings to specific purchases for post-war delivery.

Payments will be made to the Hartford-National Bank & Trust Co., which will invest the funds in U. S. bonds and send out notices of installments, these to be arranged as far as possible to fit customers' individual pocketbooks. The plan contemplates that orders will be taken for lump sums roughly corresponding to prewar prices. Later, when models and prices become available, firm orders will be made out in the usual manner. The company does not merchandise appliances. Advance orders are to be cancellable, with all payments being returned to the customer, who would forfeit only the benefits of early delivery, discounts, etc. While the plan is being made possible by the Hartford company, the sales will be made by local electrical dealers. Certificates of purchase are in process of being printed and the plan will be offered in detail by dealers, through whom particulars will shortly be announced. Discounts and installation allowances to dealers will be applied to such advance purchases, because of the benefits to industry generally in planning ahead.

In its preliminary announcement, the company pointed out that government economists have repeatedly warned about the dangers of inflation when purchasing power exceeds the supply of available goods. The OPA at Washington has been developing an elaborate plan for post-war deliveries of motor cars, pianos, refrigerators and other merchandise to be paid for out of present earnings with the foregoing objective, as well as to build up a backlog of orders to re-employ the necessary post-war labor and aid in averting post-war depression.

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WPB, FPC Disagree on War Power Needs

WPB chief Donald M. Nelson reportedly has protested to the President against the Federal Power Commission's "duplicating" activities in estimating wartime power requirements and supply. The jurisdictional dispute is understood to have been the subject of a Sunday conference between the President and Nelson and FPC chairman Leland Olds on January 3.

Apparently the matter has not been completely ironed out. At his bi-weekly press conference following the Nelson-Olds meeting, the President dismissed a question about the session with the remark that he expected a report from the two men in a week or ten days. Both Nelson and Olds agreed at the White House not to discuss the affair at this time.

At stake is the question of how much generating capacity expansion is required to meet wartime demands. The decision, in turn, can have a marked effect upon future administration in the power field.

Full jurisdiction over planning wartime power supply was awarded to WPB's power division last spring in the so-called WPB-FPC "treaty" which was approved by the President. Subsequently, in late summer, WPB completed a definitive power expansion program calculated to meet all requirements for this country's "all-out" war effort. This program, with limited modifications dictated by shifts in war production programs, is now being carried out.

Some weeks ago FPC prepared a "tentative" appraisal of the power picture in which it contended that WPB had underestimated the peak demand for an 80-billion-dollar war program by 5-to-10 million kw. and was overestimating dependable capacity—installed and scheduled—by another couple or three million kw. FPC got the President's authorization to demand full details as to war programs from the military services and WPB so it could recheck its figures.

It is this action which Nelson is protesting—both because FPC is duplicating work long ago performed by WPB and because FPC's figures are wrong. Nelson, as well as other top WPB officials, it is known, has complete confidence in the adequacy of the WPB power division's program.

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Power Pool Proves Stand-by Ability

Picks up 66,000 kw. for aluminum plant when Ark-La line fails

Contentions of the Southwest power pool that it could supply all the interim power requirements of the Lake Catherine aluminum plant in Arkansas were proved definitely late in December when, for several days, the transmission line of the Ark-La Electric Cooperative were put out of operation by a windstorm. Disclosure that the pool had taken over came from Frank M. Wilkes, president of the Southwestern Gas & Electric Co.

Ark-La has the contract to supply 32,500 kw. of the plant's requirements from the Grand River dam in Oklahoma, and the power pool has a contract to supply 65,000 kw., although under a new proposed contract only 40,000 kw. would be furnished.

When the Ark-La line went out on the afternoon of December 26 the pool immediately picked up the full load of about 66,000 kw. at the aluminum plant without any interruption in aluminum manufacture. The pool continued to supply all the outside power until the Ark-La line was restored to service several days later.

The aluminum plant has three processing units now in operation, each requiring about 32,500 kw. One of these is supplied with direct current produced in a battery of gas-fired diesel generators. The two other units are supplied with outside a.c. current, which is transformed to d.c. with rectifiers. Four units are planned for operation as soon as the second battery of diesel d.c. generators are ready for operation.

Action of the War Board canceling priorities on a 70,000-kw. station at the aluminum plant is held by state authorities to be a severe blow to the plans of the federally financed and REA-sponsored Ark-La cooperative for a big public power program in the Southwest after the war. Under the recent WPB order, the only generation to be completed at the plant is 70,000 kw. of d.c. to be supplied from the diesel engines. The a.c. plant had been planned as a permanent power supply for the plant. It is expected that the power pool and Ark-La cooperative, which have the contracts for temporary interim power, will be called upon to supply the permanent power.

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Interstate Unit Now in Operation

Because of war conditions and the consequent burdening of manufacturing facilities, fabrication of the new 12,500-hp. steam turbo-generator unit of the Interstate Power Co., which was placed in operation at the Albert Lea, Minn., plant during December, was accomplished under unusual circumstances.

War requirements made it necessary that the parts of the generator be built at various points in the eastern United States, Chicago and Dubuque, Iowa; shipped to Albert Lea and assembled for the first time in the plant where the unit was to operate. This is a radical departure from the conventional practice of manufacturing the entire unit at one point, assembling and testing the machine at the factory and shipping it to the generating station for installation. In the case of the Albert Lea machine, however, first assembly of many parts was done at the generating station.

Installation of the unit was supervised by a representative of the General Electric Co. and engineers of the Interstate Power Co. from Dubuque and Albert Lea.

Placing this new unit in operation practically completes a series of major improvements started by the company in 1941. Transmission lines between Albert Lea and Dubuque have either been rebuilt or new lines installed and voltage is being raised to 66,000, thus increasing transmission capacity about four times. New switching stations, transformer equipment, etc., have been installed at various points on the transmission lines so that now if any of the four generators at Albert Lea fail power can be supplied from Dubuque power plant or from other plants connected to the lines.

TVA Capacity Increased One-Third During 1942

Four new dams and Watts Bar steam station went into operation, annual report says, with eight new ones started — 6,000,000,000 kw.-hr. produced during fiscal year

Generating capacity of the Tennessee Valley Authority was increased by almost one-third to 1,374,500 kw. and its generation of power exceeded six billion kilowatt-hours during the fiscal year ended June 30, 1942, the agency reports. The annual report is not being published in full because it contains data "which might give aid, though certainly not comfort, to the enemy."

10-Billion-Kw. Rate

Indicative of TVA's continued wartime growth, a footnote to the report pointed out that generation is now at a rate of ten billion kilowatt-hours annually.

The report states that TVA completed and placed into operation during the fiscal year four dams and the Watts Bar steam station, started work on eight new dams (two of which also are in the completed list), continued work on four more and completed a major tie-line with Northern steam systems to strengthen its ability to meet war demands in event of low water. The finished projects are Cherokee, completed in 16 months; Chatuge and Nottely, completed in less than a year, and the steam plant, now being enlarged. New projects started are Douglas, Fontana, Apalachia, Ocoee No. 3, Watauga and South Holston; work on the last two was subsequently halted by WPB order.

Gross power revenues set a new high of $25,329,954, which, after straight-line depreciation, payments in lieu of state and local taxes and amortization, resulted in a net operating income of $4,280,252. Power plant investment at year's end was reported at $283,000,000. TVA distributors sold nearly 2½ billion kilowatt-hours of the energy generated for a gross revenue of $31,000,000, of which $7,500,000 was net operating income. Average residential use of energy was reported at 1,520 kw.-hr. and average cost 2.02 cents per kw.-hr.

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Portland Supplied by Bonneville

Bonneville Power Administration disclosed recently that it had delivered 927,000,000 kw.-hr. of Columbia River power to the account of the Portland General Electric Co. during the three years just ended. Since December, 1939, the Portland utility has received approximately 34 percent of its power needs from federal sources, it was said. Portland was one of Bonneville's first customers.

NEW CAPACITY IN MINNESOTA—President B. F. Pickard of Interstate Power Co. starts up the new 12,500-hp. unit at the Albert Lea, Minn., generating station, main generating point for electricity distributed to many towns in southern Minnesota

National Coop Group Meeting Jan. 19-20

First formal meeting of the National Rural Electric Cooperative Association, organized recently to promote public rural electrification, has been called for January 19 and 20 in St. Louis, wartime headquarters of the Rural Electrification Administration.

Theme of the meeting is announced as "Power for Food" in invitations sent all 800 REA-financed rural cooperatives by Ex-Congressman Clyde T. Ellis of Arkansas, general manager of the new organization. While all co-ops are invited, only those which are dues-paid members may have voting delegates.

Speakers scheduled for the sessions include Ellis, Secretary Ickes, ex-Senator George Norris of Nebraska, Congressman Rankin of Mississippi and Senator Aiken, Vermont Republican. It is expected the group will vote demands for extensions to farms not yet having electric service and relaxation of restrictions on manufacture of farm appliances (see page —, this issue), in line with Ellis' advance call for the meeting, which says:

"A rare opportunity exists for service to our nation at war through increased use of electric power in food production processes. We must recognize and harness the boundless energy of electricity. We must then strive to remove the shackles that have restricted the use of this power, so that we may be permitted to make our fullest contribution to victory."

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Northwestern Tech Gets $20,000,000

A sum in excess of $20,000,000 will come to Northwestern University from the estate of Walter P. Murphy, manufacturer of railway supplies, who died on December 16, it was announced last week by President Franklyn B. Snyder at a meeting of the board of trustees.

Mr. Murphy specified that the fund should be used to develop, maintain and operate the Technological Institute of Northwestern University, which was founded in 1939 with a gift of $6,735,000 from the Walter P. Murphy Foundation. Beyond this restriction, Mr. Murphy placed no limitations on the use of the bequest, leaving to the board of trustees of the university the final decision as to future management.

This is the largest bequest ever made to higher education by a citizen of Chicago and is probably the largest in the nation since 1924, when James B. Duke willed $40,000,000 to Trinity College (now Duke University).

Notification of the bequest came to President Snyder from the executors of the Walter P. Murphy estate, who informed him that Northwestern University will receive the entire estate after payment of bequests to relatives and friends, and that the value of the gift that will come to the university was estimated to be "in excess of $20,000,000."

Mr. Murphy also specified that the institute, as a part of its operations, may give instruction in science to other than engineering students.

Completed in the fall of 1941 at a cost of $5,000,000, the massive Lannon stone building was dedicated on June 15 and 16, 1942, with a series of conferences in which educational and industrial leaders of the nation participated.

It houses the departments of civil, chemical, mechanical and electrical engineering of the institute and the departments of physics and chemistry of the university. The institute is operated on the "work-study" plan in which student engineers alternate three months of study on the campus with equal periods of work in co-operating industries. It began operations in the fall of 1939, before the present building was erected, and today has an enrollment of 750 full-time students. Approximately 95 industrial organizations located in thirteen states co-operate with the institute in its work-study program.

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Order L-46 Extended

WPB has extended indefinitely Order L-46, which sets up a procedure for fullest use of the 25-cycle system in upper New York State and for curtailment in event of shortages to insure no interruption to essential war loads. The order would have expired with the New Year.

MEETINGS

Edison Electric Institute—Accident prevention committee, Hotel Gibson, Cincinnati, Ohio, February 8-9; transmission and distribution committee, Wm. Penn Hotel, Pittsburgh, Pa., February 11-12. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

American Society for Testing Materials—Committee week and spring meeting, Hotel Statler, Buffalo, N. Y., March 1-6. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Previously Listed

Missouri Valley Electric Association — Industrial engineering conference, Continental Hotel, Kansas City, Mo., January 13-14. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

American Society of Civil Engineers — Annual meeting, headquarters, New York, N. Y., January 20-22. George T. Seabury, secretary, 33 West 39th St., New York, N. Y.

American Institute of Electrical Engineers — National Technical Meeting, New York, N. Y., January 25-29. H. H. Henline, secretary, 33 West 39th St., New York, N. Y.

Order Out on Retail Inventories

Few Utilities Affected by Limitation Order

WPB's retail inventory control order, L-219, affects relatively few utilities. Only companies which maintained extensive appliance sales departments will qualify under the dollar-value standards established by the order. Those who qualify now will be forced out of the picture in the future as their inventories of non-replaceable goods are whittled down.

Affects $50,000 Stocks

Standards below which retail operations are now affected are as follows: A consumer goods inventory which, on or after last November 30, had a cost value of $50,000 or more at the end of any quarter of the fiscal year, and net consumer goods sales amounting to $200,000 or more during the twelve months preceding the end of the same quarter. Inventories include stocks held for sale in retail stores, wholesale establishments and stock-carrying branches of manufacturers.

Restrictions take effect in the second quarter of 1943, on March 1 for those companies whose tax year or quarter opened December 1, on April 1 for those companies whose tax period opened January 1, and on May 1 for companies whose tax period opens February 1.

Retail operations subject to the order shall cease to be affected when for four consecutive quarters inventories total less than $50,000 or when net retail sales for a twelve-month period under the order drop below $200,000.

The order makes no attempt to redistribute existing inventories. It does limit purchases by those retailers whose inventories are out of line with its standards. Less stringently, it governs the amount of consumer goods which may be purchased by retailers who qualify but whose inventories are not excessive. Its aim is to restrict inventories of larger concerns to approximately the same levels, in relation to sales, as they maintained before Pearl Harbor.

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Boulder Dam Now Near 1,000,000 Kw.

Boulder Dam's generating capacity was boosted close to the 1,000,000-kw. mark recently with installation of the twelfth 82,500-kw. generator. Total capacity is now more than 950,000 kw.

A similar unit is scheduled to go into operation at the dam early in 1944.

Output Turns Up Over New Year

Following the sharp year-end drop registered in the last week of September, when the amount of electrical energy distributed by the light and power industry stood at 3,655,926,000 kw.-hr. (revised from the estimated figure published last week of 3,675,000,000 kw.-hr., the curve went up again for the week ended January 2, according to preliminary estimates of the Edison Electric Institute. Figure for the latest week is 3,750,000,000 kw.-hr., subject to revision next week. This figure represents an increase of 14 percent over the 3,288,685,000 kw.-hr. figure registered for the week of January 3, 1942.

Figures for the seven major geographic regions of the country are not available for the January 2 week, but are given for the week of December 26. They show relatively the same gains in percentage over the December 19 week with the exception of the Rocky Mountain region, which fell from a 10.1 percent gain to a 4.3 percent gain for the December 26 week. The Pacific Coast area continues to lead the country in percentage gains over a year ago.

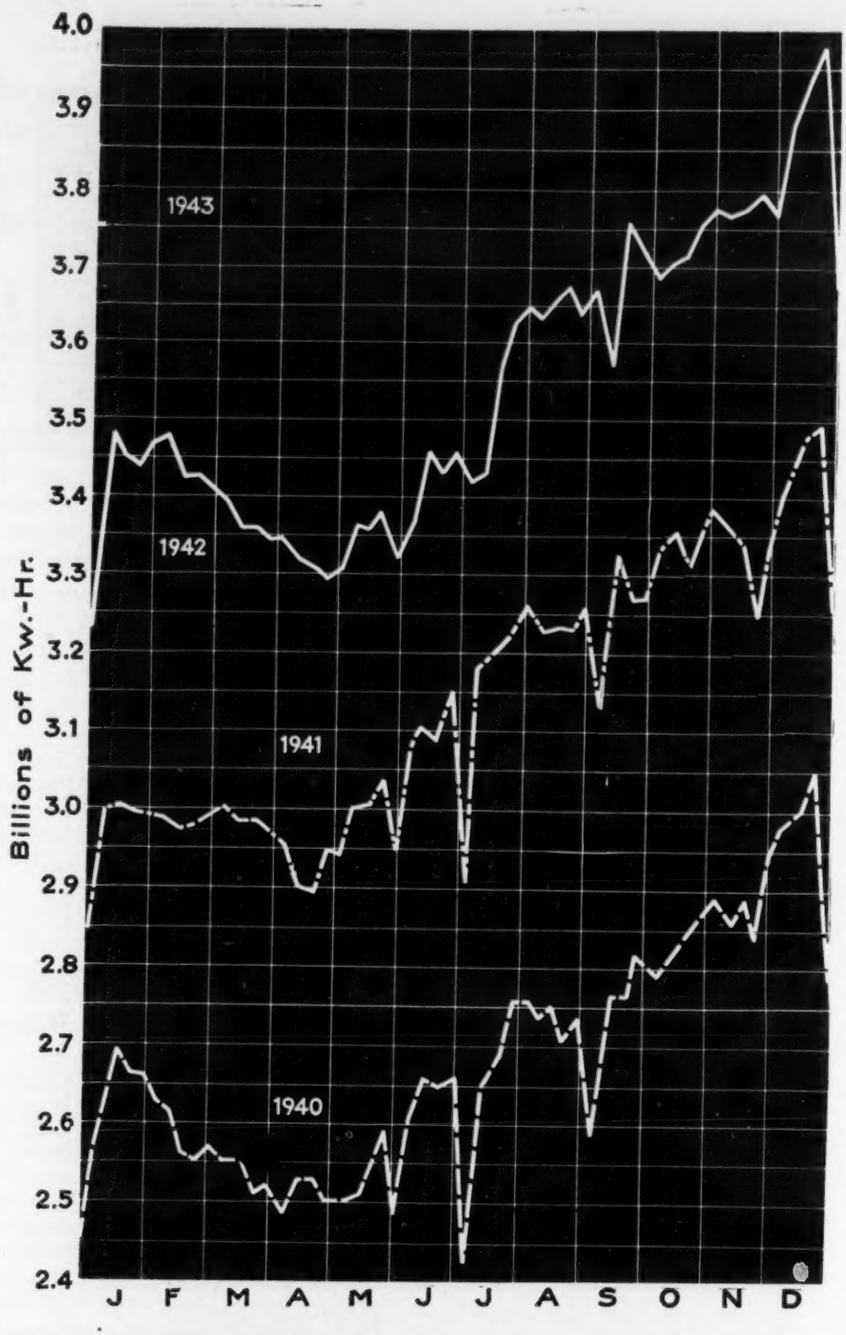
Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Jan. 2	3,750*	Jan. 3	3,289	Jan. 4	2,846
1942		1941		1940	
Dec. 26	3,656	Dec. 27	3,234	Dec. 28	2,757
Dec. 19	3,976	Dec. 20	3,495	Dec. 21	3,052
Dec. 12	3,937	Dec. 13	3,476	Dec. 14	3,003
Dec. 5	3,883	Dec. 6	3,415	Dec. 7	2,976
Nov. 28	3,766	Nov. 29	3,339	Nov. 30	2,932
Nov. 21	3,795	Nov. 22	3,248	Nov. 23	2,839
Nov. 14	3,776	Nov. 15	3,348	Nov. 16	2,890
Nov. 7	3,762	Nov. 8	3,369	Nov. 9	2,858
Oct. 31	3,775	Nov. 1	3,380	Nov. 2	2,882

* Estimated. Subject to revision.

Percent Change from Previous Year

	Week Ending		
	Dec. 26	Dec. 19	Dec. 12
New England	+ 0.4	+ 1.0	— 0.7
Mid-Atlantic	+ 6.5	+ 7.8	+ 5.3
Central Industrial	+10.7	+10.8	+ 8.4
West Central	+10.4	+10.9	+12.0
Southern States	+21.1	+21.6	+26.5
Rocky Mountain	+ 4.3	+10.1	+ 8.1
Pacific Coast	+28.1	+28.6	+29.3
Total United States	+13.0	+13.8	+13.3



Energy Sales Advance 12.8% in October

Sales of electric energy to ultimate consumers in October totaled 13,969,794,000 kw.-hr., compared with 12,380,084,000 kw.-hr. in October, 1941, an increase of 12.8 percent, according to the report issued by the Edison Electric Institute. Generation by water power plants showed a 30.9 percent increase over October, 1941.

Revenue from ultimate customers amounted to $243,094,100, compared with $228,883,900 for October, 1941, an increase of 6.2 percent.

For the twelve months ended October 31 the average annual use advanced to 1,018 kw.-hr. per customer from 980 kw.-hr. per customer for the twelve months ended October 31, 1941, an increase of 3.9 percent; average annual bill increased 1.9 percent—from $36.75 for the twelve months ended October 31, 1941, to $37.46 for the twelve months ended October, 1942; revenue per kilowatt-hour dropped to 3.68 cents from 3.75 cents.

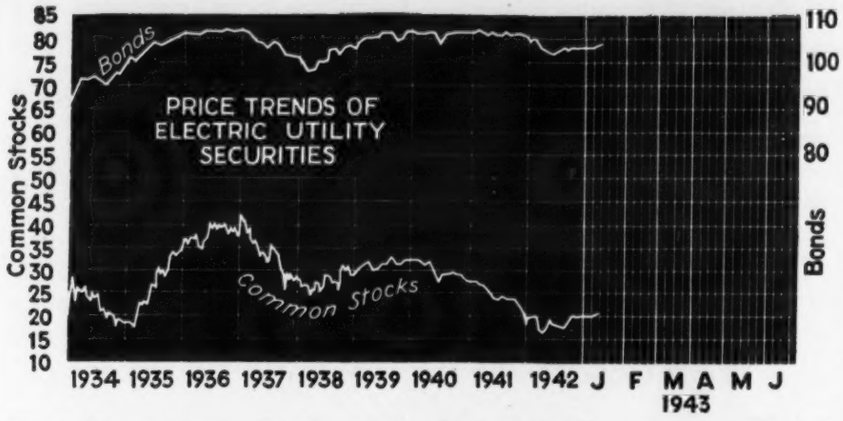
Classification of Sales, October, 1942 and Change from 1941

Kilowatt-hour sales—During month of October	Million Kw.-Hr. 1942	1941	% Change
Residential or domestic	2,224	2,092	+6.3
Rural (distinct rural rates)	269	226	+19.1
Commercial or industrial			
Small light & power	2,272	2,100	+3.3
Large light & power	7,957	6,951	+16.1
Street & highway lighting	185	193	—4.1
Other public authorities	385	275	+40.0
Railways and railroads			
Street & interurban	355	322	+10.0
Electrified steam	206	178	+15.3
Interdepartmental	118	42	+179.2
Total to ult. customers	13,970	12,380	+12.8

Southwestern Hearing Set

The SEC has set January 14 for a hearing on a recent application of Southwestern Public Service Co. to sell all the outstanding capital stock of two subsidiaries, Arizona Electric Power Co. and Flagstaff Electric Light Co., to J. C. Tucker for $775,000 in cash.

Utility Stocks Improve; Bonds Continue Gain



Electric light and power securities gained ground during the past week. "Electrical World" stock index advanced to 20.3 from 20.0 the previous week; last year, 20.1. Bonds continued upward to 104.0 from 103.7 the previous week; last year, 105.0

General Gas Unit Dissolution OK'd

The Securities and Exchange Commission recently approved a plan of the General Gas & Electric Corp., as a step in the corporate simplification proceedings of that company, to dissolve the Southern Electric Utilities Co., a wholly owned subsidiary. Under the plan General Gas will acquire all the assets and assume all the liabilities of the subsidiary in exchange for the surrender of all the outstanding securities of Southern Electric.

Southern Electric carries $82,707,500 of securities on its books, all stocks of the Associated Gas & Electric Co. Against these securities Southern electric carries a reserve for fluctuation in the value of investments in the same amount. General Gas & Electric's investment in Southern Electric is carried at $47,363,181, against which is carried a full 100 percent reserve.

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SEC Order Cites Indiana Hydro

The Securities and Exchange Commission has instituted corporate simplification proceedings under Section 11 (b) (2) of the Holding Company Act against Indiana Hydro-Electric Power Co. and its parent, Midland United Co., of which Hugh M. Morris is trustee in bankruptcy. The commission ordered that the hearing, set for February 16, be consolidated with a voluntary plant of recapitalization filed by Indiana previously.

The joint companies were ordered to file, on or before January 29, answers to allegations that voting power should be redistributed and that restatements should be made in plant account, depreciation reserve, capital account and surplus account to segregate and eliminate write-ups in the plant, investment and other accounts.

Indiana Hydro's properties include two hydro-electric plants near Monticello, Ind., operated by the Northern Indiana Public Service Co. Assets and other debits of Indiana, as of October 31, 1942, totaled $9,206,470.

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Approve Indianapolis Amortization Plan

An amortization plan offered by the Indianapolis Power & Light Co. for disposing of an amount of $7,557,503.05 on its books as the final step in making adjustments in the company's accounting system has been approved by the Indiana Public Service Commission. The commission in October ordered the accounting procedure changed and called for removal of an entry of $9,523,842.68 from the company's books and submit a plan for disposition of the other amount.

Frederick F. Eichhorn, commission chairman, said that the plan submitted, which gives the company 21 years to complete amortization of the greater portion of the amount, completes the adjustment of the Indianapolis Power & Light's property accounting to the new system now required of all utilities in Indiana and many other states. The purpose of the order, he said, was to make effective certain changes in the method of bookkeeping to conform with the uniform classification of accounts ordered March 19, 1937, by the commission, and toward which the company has ben working during the past five years. This accounting system, he continued, recognizing that certain book entries resulted from the acquisition of predecessor companies, provides for the segregation of such entries so that disposition of them could be made. Some of these entries were previously ordered charged off and the remainder now are being ordered to be disposed of over a period of time by amortization, without affecting the quality of the service rendered by the company or its finances.

FINANCIAL BRIEFS

PENNSYLVANIA PUBLIC UTILITY COMMISSION and the SEC have authorized Associated Electric Co. to buy for $1,548,860, plus accrued interest, $3,602,000 principal amount of its 4½ percent bonds, due 1956, from Metropolitan Edison Co. The funds realized will be applied to the redemption of part of Metropolitan Edison's funded debt. The SEC reserved decision on a proposal by Associated to buy $2,220,000 of its 4½ percent bonds, due 1953, from the Staten Island Edison Corp. for $955,460 plus accrued interest, and on a proposed advance of $1,050,000 by Staten Island to Richmond Light & Railroad Co.

THE SEC HAS APPROVED two transactions involving the Public Service Electric & Gas Co. of New Jersey. In one the utility was permitted to buy in the open market up to $1,000,000 principal amount of bonds of eleven of its subsidiaries at a total cost not to exceed $1,200,000. In another the company, in a joint application with its parent, Public Service Corp. of New Jersey, the latter company was authorized to sell to its subsidiary $1,087,359 in bonds of constituent companies for $994,377, plus interest.

THE SEC HAS APPROVED PAYMENT of $504,943 for expenses in the reorganization of the Community Light & Power Co. and its subsidiaries in Texas, Kansas, New Mexico, Florida, Louisiana, Arizona and Arkansas.

Utility Reports

	Net Income 1942	1941
*Alabama Power	$3,727,819	$3,431,863
*Blackstone Valley Gas & Elec.	867,246	1,008,985
†California-Oregon Power	1,205,378	2,912,811
*Central States Electric	127,055	121,597
*Commonwealth & Southern and subs	10,780,010	12,078,102
*Cons. Gas Elec. Lt. & Pwr. (Balto.) and sub	6,322,067	6,424,509
*Consumers Power	7,918,386	9,374,244
*Georgia Power	5,603,751	5,398,682
*Iowa Elec. Lt. & Power	710,631	815,282
*Northern Indiana Pub. Serv.	2,535,740	2,845,170
*Ohio Edison	3,094,547	3,992,849
*Sierra Pacific Power	545,045	721,394
*Twin State Gas & Elec.	157,594	231,480

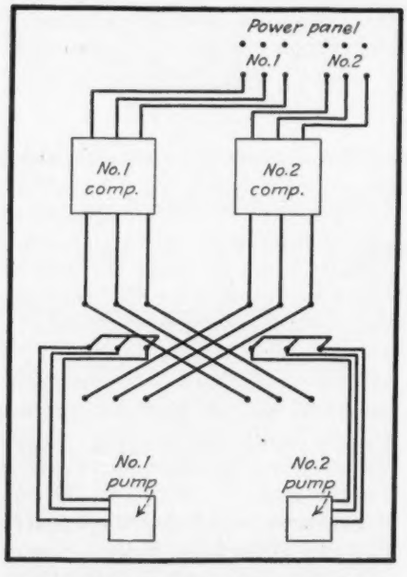
* Twelve months ended November 30.
† Twelve months ended October 31.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Circulating Pumps Made Interchangeable

By W. K. HOLMES
Chief Electrician,
Electric Department, Freeport, N. Y.

In the Freeport municipal plant there are six diesel-engine generators totalling 11,860 kva., the largest rated 2,960 kva. It is customarily cooled by water circulated from a cistern; the others by a closed circuit connected with a cooling tower. In order to promote the reliability of station operation, valves and switches have been installed in the pipe and motor wiring so that either pump may be used with either source of water and either motor may be fed through either of two circuit breakers. The electrical scheme resembles the familiar reversing connections for power supply.



DOUBLE-THROW SWITCHES provide reliability and flexibility of pump operation

Each pump is driven by a 220-volt, 15-hp. motor with compensators for starting.

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Bearings Pitted by Ground Alarm Surges

By T. M. BLAKESLEE
Los Angeles Bureau of Power and Light

Bearings on two 250-kw. motor-generator sets supplying excitation to 60,000-kva. synchronous condensers in service on the system of the Los Angeles Bureau of Power and Light showed abnormal heating and the bearing oil became black after only eight months of operation. Inspection of the bearings showed that they had developed "satin" or "frosted" surfaces. Cause of this bearing condition was traced to electrical current surges occurring across the bearing surfaces due to the ground detector scheme (Fig. 1) used on the d.c. circuits of the machines. The difficulty was corrected by installing a brush on the shaft to short-circuit the bearing oil films.

Due to the static capacities (Fig. 2) of the circuit a voltage rise occurs in the alarm relay to impress 300 volts a.c. on the field and exciter d.c. circuits to ground. The values of the capacities involved were determined by measurement and calculation and from these capacities the voltage distribution for the circuit was determined.

For the exciter portion of the circuit, C_e normally carries 163 volts effective and the oil film, C_{eb}, carries 137 volts. When the oil film of any exciter motor-generator set bearing breaks down the condenser C_{eb} is short-circuited, resulting in a surge of current between the bearing surfaces having 0.0006 watt-second of energy. Added to this is a surge of current having 0.0016 watt-second of energy resulting from a transfer of charge from C_o to C_e as the latter condenser is brought to the voltage across C_o.

In the operation of the machine

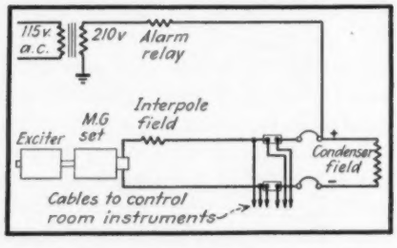

FIG. 1—Ground detector for excitation circuit of synchronous condensers

the d.c. field voltage is superimposed upon the a.c. detector voltage for that part of the cable capacity which is connected to the negative side of the exciter circuit. This d.c. component reduces the peak voltage on one-half of the cycle, but raises it on the other, and results in a tendency for more bearing pitting current surges in one direction than in the other.

Condenser Unpitted

Although the trouble in this case manifested itself in the exciter motor-generator set bearings, an analysis of the synchronous condenser circuits shows that a similar process occurs on the main machine bearings. The circuit for one main bearing capacity is completed directly to ground, while for the other bearing the circuit is

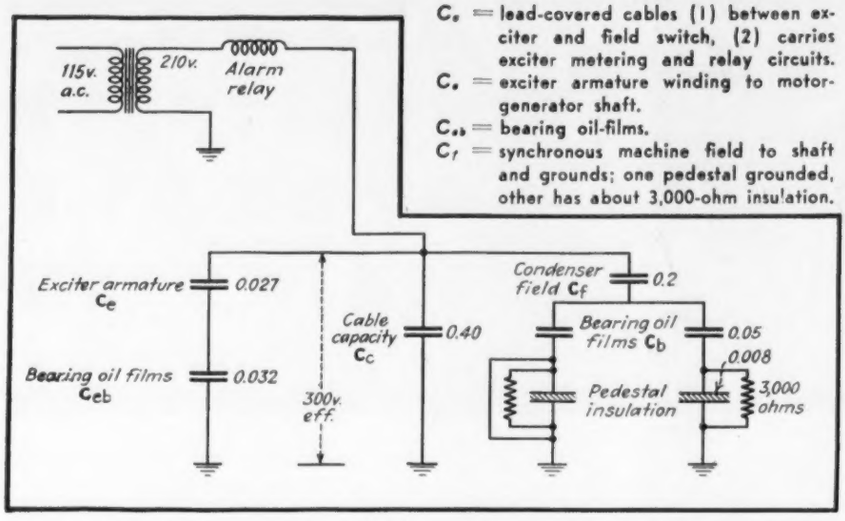

FIG. 2—Capacitance components of bearing, field and cable-sheath circuits between alarm relay and ground as outlined above

through the bearing pedestal insulation.

Circuit for the bearing on the grounded pedestal is similar to the circuit for the exciter bearings and the pitting energy is 0.023 watt-second. Circuit for the bearing with the insulated pedestal does not have the high current surges that exist in the grounded pedestal because the 3,000-ohm resistance of the pedestal insulation limits the current flow associated with the energy transfer from the reservoir, C_c, to a very low value.

For the case at hand, no pitting of the synchronous condenser bearings could be detected by bearing inspection. The machine had been operated with insulation in both pedestals and the energy associated with the discharge of the bearing capacity alone is not sufficient to leave traces of this discharge current on the large bearing surfaces. The tests, however, indicate that heavy current surges do exist, in accordance with the above explanation, through the synchronous condenser bearing on a grounded pedestal, and it is therefore believed that the operation with both pedestals insulated prevented pitting from showing up in this particular case.

Many tests were conducted both in the field and in the laboratory to demonstrate the above explained bearing pitting action. The circuit shown in Fig. 2 was set up in the laboratory and the oscilloscope inserted as it was in the field. Current surges identical to those found in the field were observed on the oscilloscope when the bearing capacities were intermittently short-circuited. Even with the cable capacity C_c disconnected current surges were still observed in each bearing circuit, although they were appreciably less in magnitude.

Ground monitoring circuits on some synchronous machines are supplied with direct current, usually from rectifiers. The voltage of d.c. ground detectors is generally quite low and its distribution across the capacities, which is dependent upon the leakage resistances, is ordinarily such that little energy is available for bearing pitting.

Installation of a brush on the shaft to short circuit the bearing oil films is rather a simple way of preventing trouble from either a.c. or d.c. ground-detecting circuits. Such a brush also furnished a positive path for tripping the ground-detecting relay which otherwise has to operate through the bearing oil film circuit.

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How to Dissipate Heat Energy in Buses*

By **WILLIAM DEANS**
Chief Engineer
I-T-E Circuit Breaker Company, Philadelphia

Heat generated by energy (I^2R) loss in an electrical conductor is dissipated by convection, radiation and conduction. Except for those cases where the conductor is immersed in some fluid, as, for instance, oil or compound, conduction is of little interest as a means for heat dissipation. The usual bus relies more upon convection and radiation. Both of these means are directly affected by the nature of the surface of the conductors. The effectiveness of convection depends also upon the nature of the inclosure of the bus. In order that convection may be effective, it is necessary that there be provision for the circulation of air.

The amount of heat dissipated by radiation is very materially affected by the nature of the surface. In general, a bright shiny polished surface will allow a minimum of radiation. It is often possible to improve the radiation qualities by painting the conductor with a dull paint or by scratching the surface. Sometimes covering the conductor with an insulating material usually thought of as a poor conductor of heat, as for instance, bakelite, or wrappings of tape, actually improves the radiation to an extent to permit assigning a higher current carrying capacity to that same conductor. While the covering may be a relatively poor conductor, the area exposed to the air is greater because the diameter of the outside of the inclosing material is greater, hence the area used for radiation is higher than the bare conductor itself.

Increased Rate

Thus for the same rate at which energy is dissipated from the surface per unit area, a greater amount of energy may be dissipated from this greater area. If, also, the rate at which energy will be dissipated per unit area from the new material is greater—that is, its emissivity is greater—then there is a further increase in the rate at which the heat energy is dissipated. This explains the increase in possible current rating for the inclosed conductor. In tests it has been found that the temperature rise of the bare conductor carrying a certain amount of current actually is higher than the temperature rise of the same conductor carrying the same amount of current, but covered with bakelite or tape wrappings a quarter of an inch thick.

The shape of the conductor itself has much to do with the temperature rise of that conductor. If the exposed area is high compared with the volume of the conductor, heat generated in the conductor will escape more easily and the temperature rise of the conductor will be low.

*This is the second in a series of seven articles on the general subject of bus design, which began in the Dec. 26, 1942, issue of "Electrical World."

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—interchangeability between your old and new bushings.

—the extent of interchangeability between bushings used on apparatus of different classes.

—which new bushings to select when replacing damaged or superseded types.

—whether it is feasible to repair defective bushings, or whether they should be replaced.

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A and **B** include application information on practically all General Electric Types OF (oil-filled) and L (liquid-filled) bushings—also superseded Types CF (compound-filled) and S (rigid-core) bushings—that have been manufactured since 1916. Catalog Numbers of both old and new bushings are listed in easy-to-use tabular form to give you complete information on bushing interchangeability.

C and **D** contain data—including descriptive information, weights, dimensions, and electrical data—on Types OF and L bushings of modern design, and are invaluable companion pieces to application bulletins **A** and **B**.

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GENERAL ELECTRIC

Mobile Power Unit Reels Wire and Cable

By HARRY M. JENSEN
Public Service Company of Northern Illinois, Chicago

Shown in the accompanying illustrations is a portable power unit developed by the author for reeling and coiling cable or wire of all sizes. Mounted on a standard storeroom skid and weighing 1,360 lb., the unit can be moved from place to place with a four-wheel hand truck or electric lift truck. This unit was built from scrap parts and is shown in the illustrations both with and without its cover.

The reel drive has four speeds—3½, 7 and 13 and 22 r.p.m., both forward and reverse. This speed variation is obtained with a four-speed truck transmission powered by a 5-hp., three-phase, reversible 1,175-r.p.m., 220-volt motor. A triple V-belt drive connects the motor and transmission drives direct through a double-universal shaft to a 17:1 worm gear reduction box. The slow-speed or output side of the reduction box is equipped with a sprocket gear and 1¼-in. roller chain that turns the double-eared dog on the reel head at the end of the adjustable arm.

A collapsible coiler of the type commonly used on line trucks is also part of the power unit. It is driven by the power take-off of the truck transmission through a three-speed passenger car transmission. Shaft on the output side of the transmission is equipped with a sprocket gear and ¾-in. roller chain which drives another sprocket gear on the 1¼-in. coiler shaft. This 1¼-in. shaft rides on two bronze bearings and is arranged at one end to hold and drive the collapsible coiler which operates at 12, 22 and 36 r.p.m. in either direction.

Both the reeling device and the coiler are controlled by a small foot switch at the end of a two-wire rubber extension cord connected to a magnetic switch inside the cover. When the machine is not in use the switch can be disconnected by pulling the plug from the single receptacle at the side of the machine.

A reversing switch is located on one side of the machine. This switch changes the direction of the motor, which allows all variable speed in either direction.

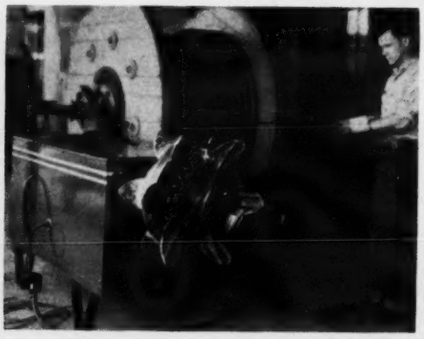
When using either one of the driving devices the other can be put out of service by inserting the respective transmission in neutral.

•

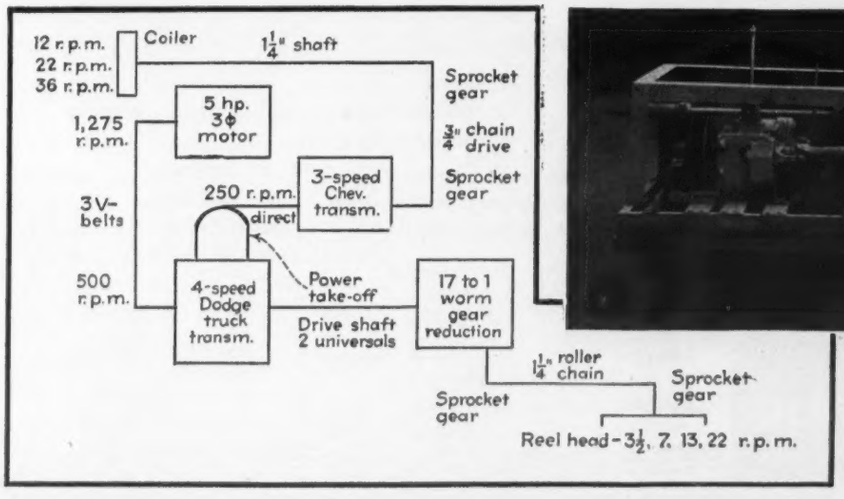
Skeleton Partition Holds Meter Stock

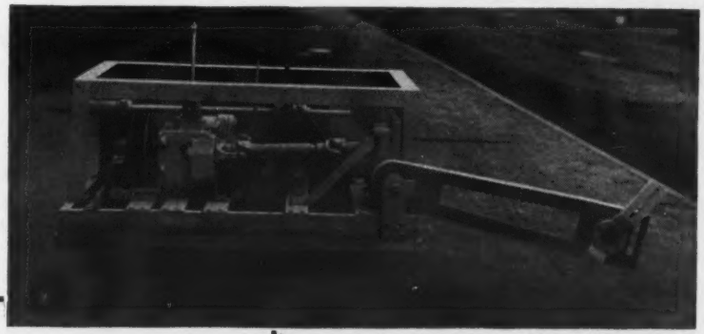
Purposes additional to that of a simple partition are served by the wall erected to inclose the meter department in a corner of the warehouse and service building of the Durham (North Carolina) Public Service Company.

The wall consists of 2 x 4-in. vertical studding on 8-in. horizontal spacing, thus leaving 6-in. openings between adjacent scantlings. These openings let light and air into the meter department inclosure. Meters in stock are hung on the inner side of the partition. Thus the meter department is effectively separated from other operations on the floor, but is not cut off from light and ventilation.



MOBILE POWER UNIT, extreme right, in use winding length of power cable on reel; note control switch under foot of man at right. In view at right is shown a collapsible reeler of type used on line trucks, attached to power unit for reeling line conductor; note cable reel attached to unit in background





POWER UNIT with cover removed; when not in use reel head projecting at right can be "folded" back, counter clockwise

DIAGRAMATIC representation of mechanical elements of power unit

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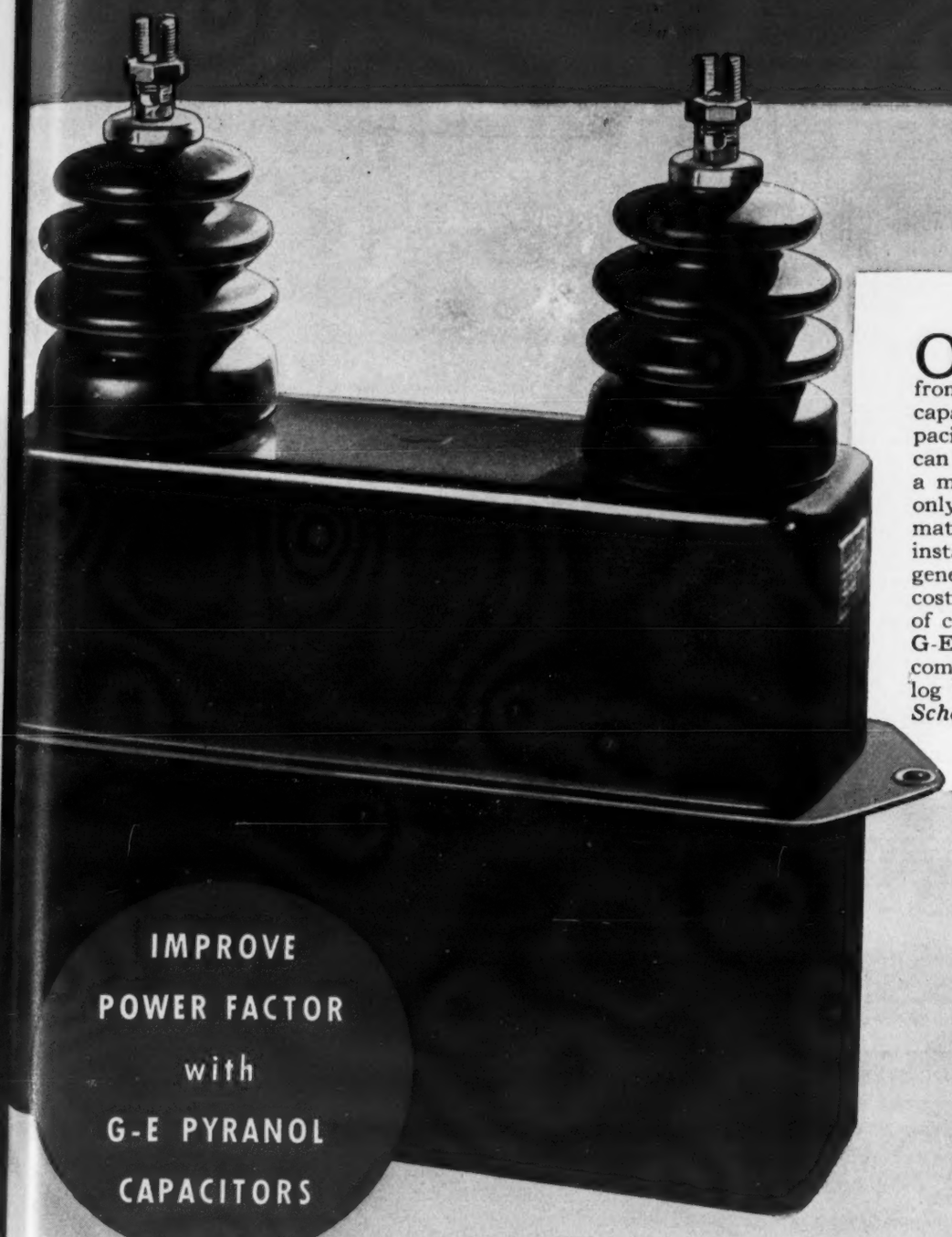
the Quick, Low-cost Way and Save CRITICAL MATERIALS



ON a system where power factor is low, you can release from 0.3 to 0.6 kva of system capacity for each kva of capacitors you install. Capacitors can be obtained and installed in a matter of weeks; they require only a fraction of the critical materials you would use in the installation of new feeders or generating equipment. And the cost is only about $7.00 per kva of capacitors installed. Ask your G-E representative today for complete information and Catalog GEA-3333. *General Electric, Schenectady, N. Y.*

IMPROVE POWER FACTOR with G-E PYRANOL CAPACITORS

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

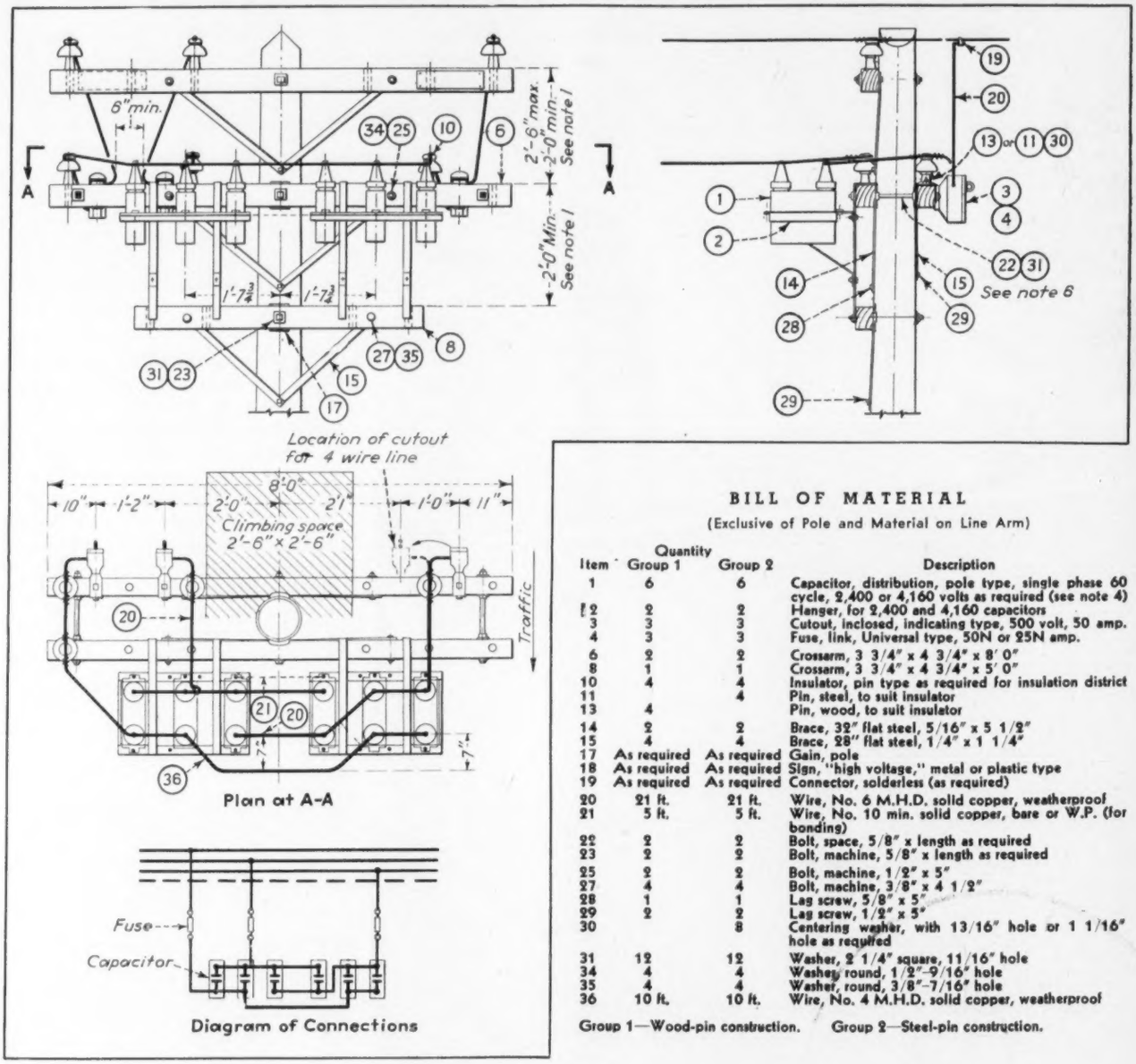
GENERAL ELECTRIC

660-42-5700

HOW TO MOUNT

POLE-TYPE DISTRIBUTION CAPACITORS*

For an installation totaling 90 kva. of 2,400 or 4,160-volt capacitors, using six 15-kva., single-phase units delta connected on a single-circuit three- or four-wire line



BILL OF MATERIAL

(Exclusive of Pole and Material on Line Arm)

Item	Quantity Group 1	Quantity Group 2	Description
1	6	6	Capacitor, distribution, pole type, single phase 60 cycle, 2,400 or 4,160 volts as required (see note 4)
2	2	2	Hanger, for 2,400 and 4,160 capacitors
3	3	3	Cutout, inclosed, indicating type, 500 volt, 50 amp.
4	3	3	Fuse, link, Universal type, 50N or 25N amp.
6	2	2	Crossarm, 3 3/4" x 4 3/4" x 8' 0"
8	1	1	Crossarm, 3 3/4" x 4 3/4" x 5' 0"
10	4	4	Insulator, pin type as required for insulation district
11		4	Pin, steel, to suit insulator
13	4		Pin, wood, to suit insulator
14	2	2	Brace, 32" flat steel, 5/16" x 5 1/2"
15	4	4	Brace, 28" flat steel, 1/4" x 1 1/4"
17	As required	As required	Gain, pole
18	As required	As required	Sign, "high voltage," metal or plastic type
19	As required	As required	Connector, solderless (as required)
20	21 ft.	21 ft.	Wire, No. 6 M.H.D. solid copper, weatherproof
21	5 ft.	5 ft.	Wire, No. 10 min. solid copper, bare or W.P. (for bonding)
22	2	2	Bolt, space, 5/8" x length as required
23	2	2	Bolt, machine, 5/8" x length as required
25	2	2	Bolt, machine, 1/2" x 5"
27	4	4	Bolt, machine, 3/8" x 4 1/2"
28	1	1	Lag screw, 5/8" x 5"
29	2	2	Lag screw, 1/2" x 5"
30		8	Centering washer, with 13/16" hole or 1 1/16" hole as required
31	12	12	Washer, 2 1/4" square, 11/16" hole
34	4	4	Washer, round, 1/2"-9/16" hole
35	4	4	Washer, round, 3/8"-7/16" hole
36	10 ft.	10 ft.	Wire, No. 4 M.H.D. solid copper, weatherproof

Group 1—Wood-pin construction. Group 2—Steel-pin construction.

NOTES

1. All metal parts including metal gains not in permanent contact must clear each other 1½ in. minimum creepage or 1 in. minimum striking distance.

2. Bond capacitor hangers only.

3. Leads shall be connected to opposite sides of each cutout to increase leakage path.

4. Use 2,400-volt capacitors on 2,400-volt line and 4,160-volt capacitors on 4,160-volt line.

5. Maintain 6 in. minimum clearance between adjacent phases.

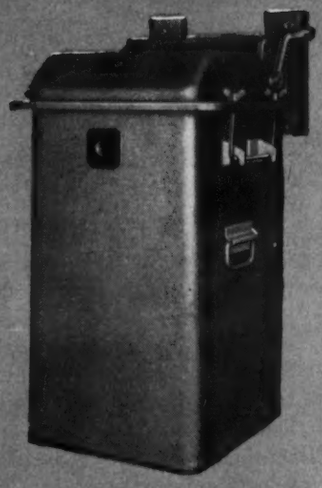
6. For steel pin construction locate bolts for 28-in. braces 15-in. from center line of pole, on cutout arm, to clear steel pin.

7. "High-voltage" signs required only on face and back of line arm. If other circuits are carried on same pole, cutout arm must have sign on climbing space side.

* From a book of standard practices of a western utility.

Don't WASTE MAN-HOURS AND CRITICAL MATERIAL Building Special Enclosures

...there's a STANDARD G-E combination starter to meet every operating condition



CORROSION-RESISTANT

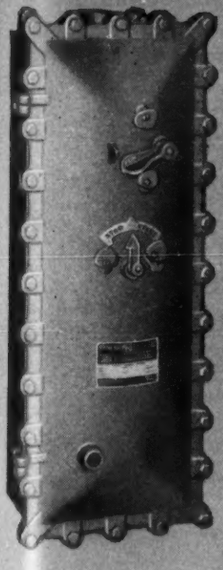
These starters (Type 8) are made in two forms—one for corrosive atmospheres and one for hazardous locations. All their arcing parts and terminals (for use in hazardous locations) are at least six inches under oil.

GENERAL-PURPOSE

The Type 1 enclosure is suitable for general-purpose, indoor applications where atmospheric conditions are normal.

DUST-TIGHT

The Type 5 enclosure is for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so heavy as to make a dust-tight case desirable. The cases are of heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.



FOR HAZARDOUS LOCATIONS

The Type 7 case for Class 1, Group D, locations is made of cast, high-strength alloy. These starters can withstand internal explosions. The flanges, which are securely bolted on all sides, are ground to tolerances that will not permit the escape of hot gases.

WATERTIGHT

The Type 4 case is suitable for outdoor use, and for installations in damp places indoors, such as in dairies and breweries.

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Order STANDARDS *to save time and material*

NEVER ENOUGH production time—scarce material urgently needed! Both far too valuable to be spent in building unnecessary control rooms and special enclosures.

But delivered-ready-to-install control isn't all that the General Electric line of standard combination starters offers you.

These starters combine two devices—a fused motor-circuit switch and a magnetic starter—in one compact unit. This saves you one complete mounting job. They come to you completely wired and ready to install—saving all the time and material needed to wire up two individually mounted controls.

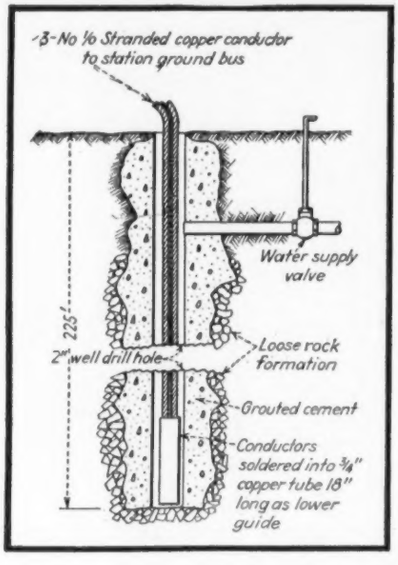
If you wish, our local sales engineers will help you select the proper starter for your job from this standard line of G-E combinations—for a-c motors up to 200 hp. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

Drilled Well for Good Desert Ground

By A. FRANK AYRES
California Electric Power Company, Riverside

The problem occasionally confronting utilities of obtaining a satisfactory station ground in desert and mountainous locations was recently solved in a rather unusual manner. Early this year the California Electric Power Company contracted to supply the Basic Magnesium, Inc., mining operations at Gabbs, Nev. A new 64-mile transmission line and receiving substation, including a synchronous condenser, were required. Preliminary investigation disclosed that obtaining a satisfactory ground at the receiving station would be a particularly difficult job. For this reason it was decided to resort to a drilled well to provide the basis of the station ground system.


3-No 1/0 Stranded copper conductor to station ground bus
Water supply valve
225'
2" well drill hole
Loose rock formation
Grouted cement
Conductors soldered into 3/4" copper tube 18" long as lower guide

DETAILS of 225-ft. cemented ground well necessary to provide satisfactory ground for desert substation

Completed ground well is approximately 225 ft. deep, but still well above water bearing strata. Because of this arrangements were made to water the well from above. Three No. 0 stranded copper conductors were soldered into a short length of copper tubing to serve as a guide in lowering the conductors into the well for its entire length. The well itself was a little over 2 in. in diameter and mainly of drilled concrete which had to be poured in and allowed to set because of loose rock formation.

Finished ground well has a resistance of 0.8 ohm. As a comparison, a group of well-watered driven rods which were in use before completion of the well had a resistance of 4.8 ohms. This ground well is considered entirely satisfactory to serve as the only grounding point for all electrical equipment in the receiving station.

•

Old Plant Accepted for War Duty

An Eastern steam plant serving a utility system handling a major war industry load had an installed rating of 55,000 kva. in generator capacity, but the installation dates of its turbine sets went back to 1910 and ended in 1921. The equipment consists of two 5,000-kva. units, one 20,000-kva. set and one 25,000-kva. machine, and the firm capacity of the plant, arrived at by deducting the rating of the largest generator from the total installation rating, is 30,000 kva., or 24,000 kw. at 80 percent power-factor. The station's maximum output was limited by boiler capacity to 35,000 kw. at the time of a recent investigation of its economic usefulness.

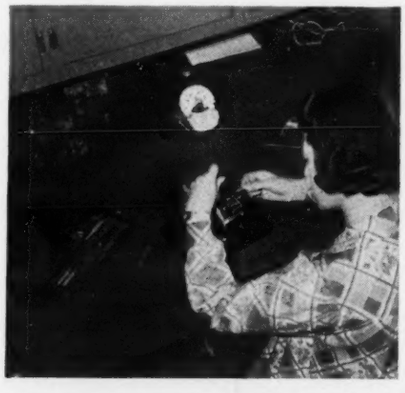
Peak load of the system was 44,000 kw. at this time. Normally a large part of the load is handled by interconnected hydro and steam facilities, the plant being held in reserve as a standby. About 20,000 kw. of primary hydro was available. The old plant's fuel showing is about 2 lb. per kilowatt-hour, when operated. The question of building a new station on the opposite side of the river on which the plant stands arose and was accentuated by the war. At the then price of coal it was apparent that a saving of 1 lb. per kilowatt-hour would represent 3 mills if the new plant were built, and applied to a 30,000,000 kw.-hr. output would represent a gain of $90,000 per year. The new plant, however, would cost about $3,000,000, and fixed charges on this at 13 percent would total $390,000 per year.

Even though the older plant were run at times but a few hours per year, it was maintained in readiness for standby service at all times, and an original investment of about $3,600,000 was found to be justified for such service and an asset to the system under war conditions regardless of the high cost per kilowatt-hour of the standby energy thus developed. Demands made upon the company in certain periods could not have been met had not the old station been available to generate much of the required output. Besides serving as a standby the old station is useful as a center of distribution for a nearby downtown area. The case illustrated the importance of maintaining old equipment in good shape for use under present-day conditions, and showed that even if new apparatus were available on high priorities, the old plant fits into the system economic situation better than any other scheme considered in the analysis.

•

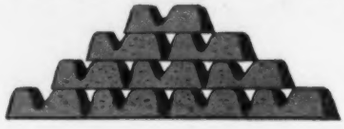
Home Service Girl "Takes" to Meter Work

By February, 1942, draft and industry manpower requirements cut into the personnel of the meter shop at Nebraska Power Company to the point where replacements were growing difficult to get and keep. As an experiment, meter superintendent Hampson at that time accepted the transfer of Mrs. Edna King from the home service department to the meter department. She was assigned to testing, cleaning and repair of demand registers, jewel and pivot inspection and cleaning, watt-hour meter, register checking and repair, as well as the testing, cleaning and oiling of clock motors, and has continued in this type of work since.



OMAHA UTILITY uses woman for register repair and inspection

Mrs. King is the first woman to work in the meter shop of the Nebraska Power Company to date; however, the facility with which she assumed metershop duties recommends possible further use of women in this type of work, it was indicated.

When this much copper will carry the electric load and protect from corrosion--it is wasteful to use this much  for mechanical strength. Copperweld can use this much copper and this much steel---and <u>do the same job with a clear saving of 70% copper.</u>

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Maintenance of Insulating Oil

VI. Re-refinement Process*

By L. M. LIMPUS
Superintendent of Reclamation
Oklahoma Gas & Electric Company

Organic acids and other oil soluble oxidation products are generally removed by the rerefinement of insulating oils. Many such rerefining processes have been developed showing indications of successful oil reclamation. These processes may be divided into two general classes, (1) straight filtration through activated or natural bleaching clays and (2) chemical absorption or neutralization in connection with some form of clay treatment. The straight filtration process requires a nominal investment in equipment, but the operating costs range between 7 and 10 cents per gallon, due to the large quantities of clay consumed, the large amount of labor required and the amount of oil lost in the process. We have used bauxite and fuller's earth and concur in the general opinion that the resultant product is slightly inferior to new oil, but the degree of inferiority is insufficient to condemn the process, and it has an advantage of portability which should not be overlooked.

Chemical Process

The chemical process requires an investment of about $5,000 for a plant capacity of 750 to 1,000 gal. per day. This amount is estimated on the basis that either a heating plant or centrifuge will be required as a part of the new equipment. If both are available a suitable plant may be constructed for about $3,000. This process contemplates either the absorption of the organic acids by sulphuric acid, or their neutralization by alkalies, and the absorption of other solubles by contact with clay. It is a simple adaptation of the original refining process, giving a product which experienced operators claim is equal to or better than the original oil, at a direct reprocessing cost ranging from 3 to 5 cents per gallon. It is interesting to note that disinterested chemists believe, however, that no rerefined oil can equal the over-all quality of a good new oil. I believe this question is debatable and future discussions of this subject should be of interest to the operating engineer.

We have had experience with a plant of this class for only six months and, to date, all indications are quite satisfactory. Other utilities have had more experience.

Our process consists of neutralizing the oil with tri-sodium phosphate at 80 deg. C., settling over night and centrifuging, then contacting it with a commercial activated clay, and filtering it into permanent storage through a combination centrifuge and blotter press. Our total cost, which includes handling, transportation and the make-up of field "shortages," is estimated at 9 cents per gallon. The reduction in neutralization number is the controlling factor of the process, with power factor reduction running a close second, and color improvement merely a desirable feature. There is extreme danger of over-refinement if color alone is used as the principal criterion, with the result that high acid concentrations will quickly develop unless the oil is sealed against the possible absorption of oxygen.

Operating engineers should not expect miracles from any rerefining or reclamation process, hoping to obtain from an inferior base a product which will prove equal or superior to a new properly refined insulating oil.

Development of simple detergents and inhibitors is eagerly awaited by operating men now face to face with the problem of salvaging vast quantities of highly deteriorated insulating oil before it leads to premature apparatus failure.

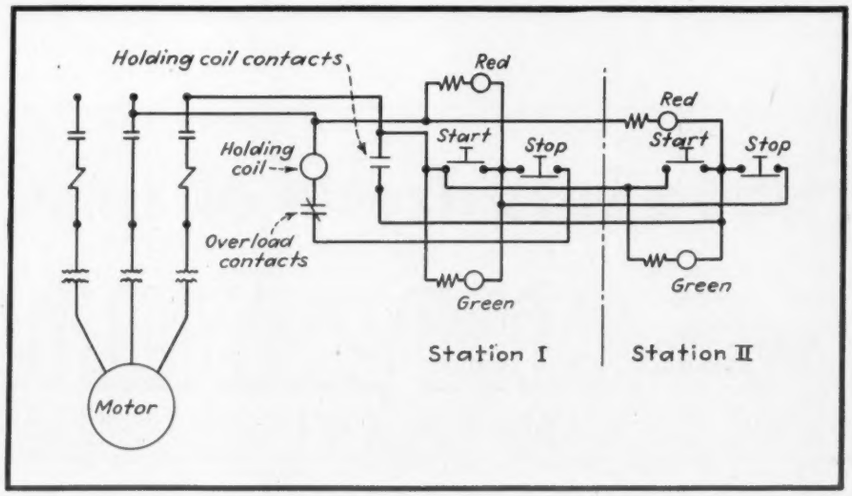
*This series began in the October 31, 1942, issue of "Electrical World."

•

Remote Lamps Show Motor Operation

Operating status of the service water pump supplying the turbine oil cooler at Spy Run plant of the Indiana Service Corporation, Fort Wayne, Ind., is given at a glance by an ingenious arrangement of signal lamps at each of the two remote motor control stations. Circuit for the lamps and controls is shown. Condition of the red and green lamps at each station indicate whether the pump is running or stopped, whether the supply circuit is energized or dead, and if the overload trip is out and must be reset. Formerly the operator had to make a trip to the pump house, some distance away, to establish these facts.

The pump motor is controlled by a conventional magnetic across-the-line starter. The red lamp at both stations will shine full brilliance if the motor is operating. If the motor is not operating, but the line supplying the motor is energized and ready for operation, the green light will be lighted. In the event an overload has caused the thermal overload contacts to open this will be indicated by both red and green lamps burning half brilliance. Under this condition they are both in series across one phase of the motor supply line. When both the red and green lamps are out, completely, there has been an interruption in power supply to the pump motor.



LAMPS at remote motor control stations indicate when service water pump is operating or stopped or tripped on overload; start button normally open except on starting; stop button normally closed except on stopping; overload contacts normally closed

34500 Volt Oil Switch

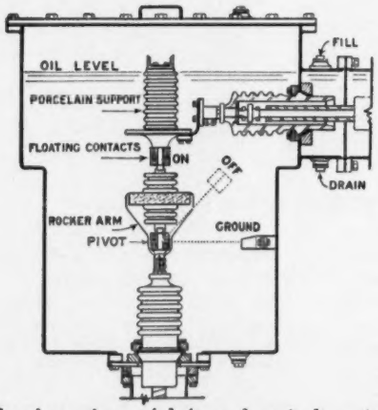
sectionalizes 5 three phase cables. Two feeders and three branches connected to a common bus.

A large shipbuilding and dry dock company required a large amount of power to carry on its activities. They secured electric service at 22,000 volts from a utility company who brought two circuits into the shipyard.

The actual load centers were widely separated hence it was decided to terminate the utility company's supply circuits at a central location and branch out from there to unit substations in different locations. At these substations the circuits are stepped down from 22 Kv to 4 Kv. A 4 Kv underground cable system was laid out in radial circuits with facilities for interconnecting the circuits into loops, using G&W Type "FCBX" oil fuse-switch boxes for sectionalization and protection.

G&W 34.5 Kv Type "RA" oil disconnect units are used for sectionalizing the shipyard's 22 Kv branch circuits from the mains supplied by the utility company's two incoming circuits.

The section view shows the left-hand end switch unit. The middle switches have horizontal bus connections in both directions. The cables are terminated in the compound filled potheads on the bottom. Each cable can be independently connected to the bus, to the open position, or to ground. The operating handle can be padlocked in any of the three positions.

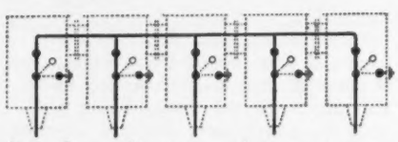


Section view of left end switch unit.

The switching links are encased in porcelain bushings mounted in a wood strap attached to rocker arms pivoted in line with the lower contacts. The links have full floating contacts at each end. The operating shaft is sealed with a rotary oil seal.

The upper stationary contacts are mounted on the inverted porcelain supports and connected to the busses with flexible copper braid. The busses have separable connectors within the horizontal porcelain bushings — for convenience in making the mechanical interconnections of the switch units. The pothead and bus porcelain insulators are identical—unit detachable style. The bus compartments are filled with oil rather than compound.

The initial installation of the 5 unit switch assembly proved so satisfactory that additional installations of several 3 unit assemblies were made to take care of expanding facilities. Consulting engineer, James M. Todd, Citizens Bank Bldg., New Orleans, La.



One line diagram of connections.

G & W ELECTRIC SPECIALTY CO.

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Also made in Canada by Powerlite Devices, Ltd., Tor.

HOW* TO { EXECUTE SWITCHING ORDERS / USE HOLD CARDS / PLACE CONSTRUCTION TAGS

Switching Orders—In all switching orders the switches shall be referred to by their *numbers* and not by the name of the circuit which they control. The sequence in which the switch numbers are given, in the order, shall indicate the sequence of the switching operation. For example, an order given: "Open switches 502-509 and close switches 511-512" shall be executed as follows: First, open switch 502; second, open switch 509; third, close switch 511; fourth, close switch 512. *No deviation from this rule will be permitted.*

To avoid misunderstandings and to prevent accidents, all orders concerning switching operations, or the handling of lines and equipment, must be repeated to the person giving same, and identity of person giving order secured. Likewise, the load dispatcher or operator giving an order must secure identity of person to whom order is given.

Switching orders must be written on a piece of paper by operator receiving same and this written order must be carried by operator while doing the switching. In no case shall an operator attempt to execute a switching order from memory.

Operators must realize that the safe execution of orders depends to a large extent upon them. It is essential, therefore, that every order received shall be clearly understood with regard to the safety of execution. In case there is *any* doubt as to the correctness of an order, the person giving same should be consulted and a reasonable explanation requested. Furthermore, if, during the process of executing an order, the operator has reason to believe that any further switching would be an error, he should stop at that point, report the switching that has already been done to the person giving the order, and request a reasonable explanation of the remaining part of the order.

Immediately after executing a switching order, the operator must report to the local dispatcher and enter the switching on the station log sheet in the exact order in which it was done.

Hold Cards—Before clearance is given for work on any line or apparatus, special tags, or hold cards, shall be placed on each and every piece of apparatus, which, if operated, might endanger the safety of the men doing the work. Three types of hold cards are used and are commonly known as small hold cards, large hold cards, and special hold tags.

Small hold cards shall be used by the station operators in tagging equipment that comes under the jurisdiction of the load dispatcher. They cannot be placed or removed except by the dispatcher's order. When the small hold card has been properly filled out, it should be placed on the control switch of the oil switch to be tagged, or in a conspicuous place on the switchboard. A special large red tag must be placed in a conspicuous place on or near each disconnect or air break switch that is tagged.

Large hold cards are used by load dispatchers and station operators as follows:

The load dispatcher must place large hold cards on the dispatcher's board for workmen to whom clearance has been given, in order to indicate the line or apparatus being worked upon, and switches which have been opened and tagged at his orders. These cards shall not be placed on dispatcher's board until the proper switches have been opened and the small hold cards placed by the operators. They shall in no case be removed until the man having clearance has reported clear.

Station operators shall issue large hold cards to workmen receiving clearance on lines or equipment which come under their jurisdiction. These cards shall be placed in a conspicuous place on the switchboard and removed only when the workmen to whom the card is issued reports clear of the lines and equipment.

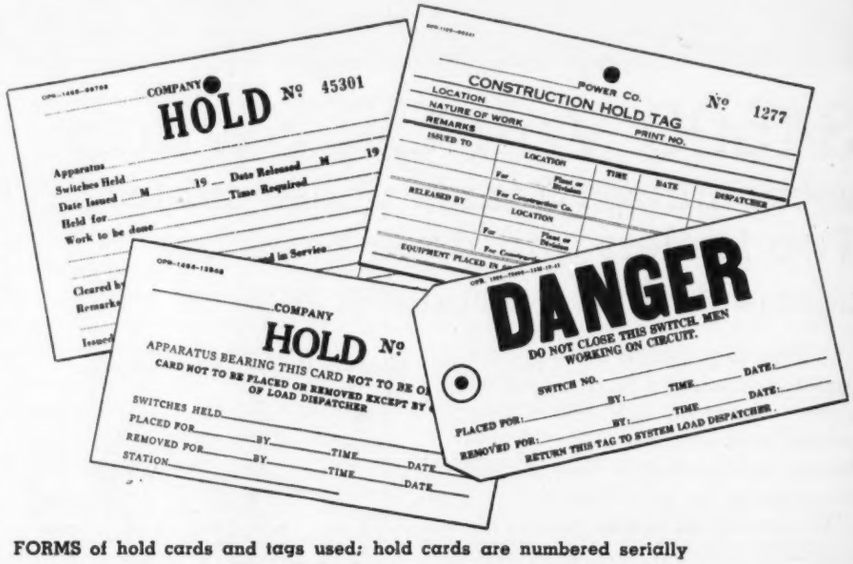
Special hold tags are used by workmen when taking their own clearance on equipment which does not come under the jurisdiction of either load dispatchers or station operators. This tag must be tied on control lever of switch controlling the circuit to be worked on and is a warning that some one is working on the circuit and switch should not be closed.

New Construction or Reconstruction Tags—On all new construction or reconstruction work construction tags shall be placed by the load dispatcher or operator. No new work or reconstruction work will be allowed to go in service until the provisions of this order have been met in every respect.

The purpose of the construction tag is to prevent any new or reconstructed apparatus or equipment from being connected to the system until it has been properly inspected and approved by the division superintendent or his representative. The large tag is to be used exclusively by the division load dispatchers when the voltage is 22 kv. or above. The small tag is to be used by operators and sub-dispatching offices. The routine will be:

The operating engineering department will forward to each station concerned a print showing contemplated work. As soon as the division load dispatcher receives his copy he will attach a large construction tag to it and request all other stations concerned to attach a small construction tag to their copy.

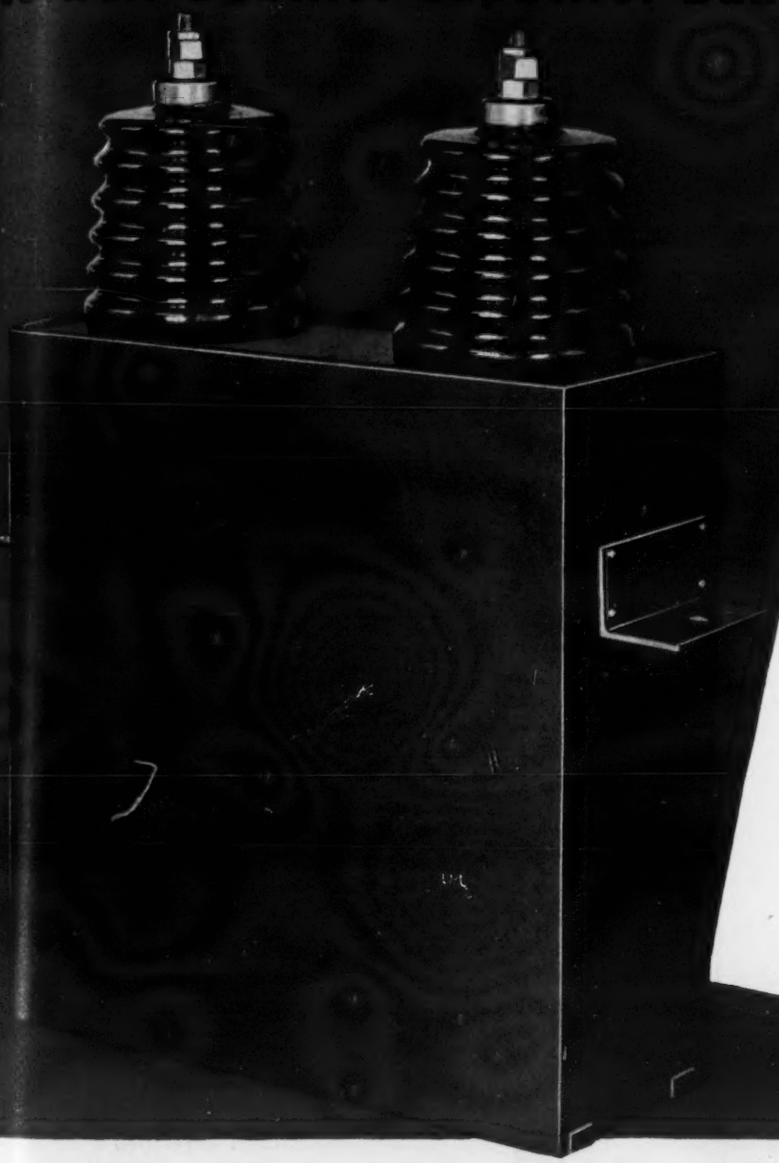
The apparatus or equipment involved is to be cut in *only* after this small construction tag has been cleared by division load dispatcher. On apparatus or equipment below 22 kv. operator of station concerned will act as load dispatcher.



FORMS of hold cards and tags used; hold cards are numbered serially

*According to operating procedures of the Alabama Power Company.

"REACTIVE"



Large blocks of leading reactive current can be obtained quickly by using banks of Cornell-Dubilier Capacitors. Not only will this method increase the voltage at critical load points—but it will also improve system capacity. Several utilities have solved the problem of new, large, concentrated loads by using C-Ds in banks up to 50,000 Kva.

C-D Capacitor banks can be quickly reassembled to provide a variation in the corrective capacity supplied, to conform to load requirements. This affords an electrical and physical flexibility not available in other types of corrective equipment. Our engineers will be glad to discuss with you the advantages of C-D Capacitor banks as applied to your specific system problems.

Cornell Dubilier Electric Corporation,
South Plainfield, New Jersey.

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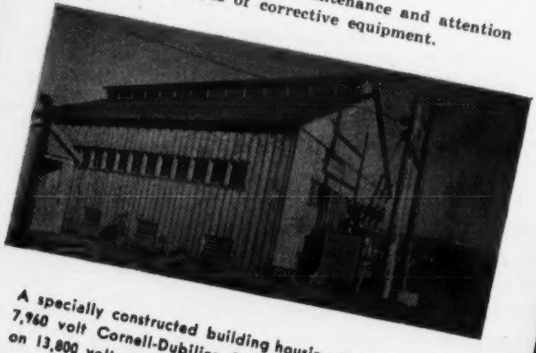
Capacitors are the most efficient reactive source.

Capacitors use less critical materials and manhours than other types of corrective equipment.

Capacitors can be installed and put into operation at a fraction of the time required for other types of corrective equipment.

Capacitors require less maintenance and attention than other types of corrective equipment.



A specially constructed building housing 20,160 Kva of 7,960 volt Cornell-Dubilier Capacitor units operating on 13,800 volts in 3 phase wye connection.

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capacitors *for power-factor improvement*

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Keeping Up To Concert Pitch

To maintain safety and construction standards in the Woburn transmission and distribution headquarters in Boston Edison's northern territory, dummy pole line facilities have been set up under direction of Alfred G. Neish, assistant head of the division, for "rainy day" practice training of linemen. In general, these facilities apply to the 4-kv. distribution of the company, both overhead and underground, and cover wiring for street lighting, erection of distribution type transformers, crossarm work, use of secondary racks, making of joints, and safety methods. About 25 linemen have had the benefit of this practice training thus far, and it is useful in applying revised methods as well as a "refresher course" in ordinary routines.

As Woburn is an important system area in relation to 110-kv. transmission, facilities have also been set up to cover some phases of high-line

construction and maintenance. In the illustration (left to right) are, top, L. Devine and C. Falbush; lower section, J. MacDonald and Philip MacMahon (foreman).

Installation of the booster transformers, as shown, raised circuit voltage to about 125 volts and had the effect of reducing the number of false starts. Trouble with blinking and short lamp life stopped abruptly.

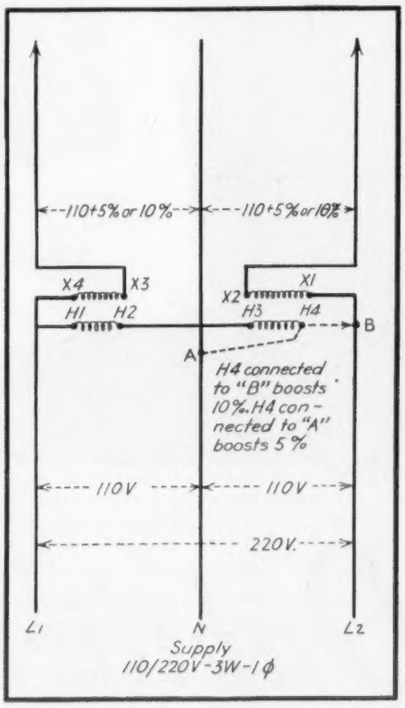
As a result very few fluorescent installations are now made in Kansas City without boosters. Usually a 10/1 ratio sign lighting transformer is used having a volt-ampere rating of around 10 percent of the load to which it was connected. To date the largest installation is rated 1 kva., but by far the majority are ½ and ¼ kva., capable of taking care of installations of 50 lamps or more. Cost of such boosters increases the installation cost from $18 to $24, depending on size and usually represents a very small fraction of the cost of each job. Transformer boosters are in most cases installed at the distribution panelboard of the installation, one transformer being sufficient for most installations.

Boosters Correct "F" Lamp Troubles

Small transformers, connected as compensators or auto-transformers, are becoming almost a standard practice in Kansas City to boost fluorescent lamp circuit voltage from 115 volts to around 125 volts. Developed as a measure to correct low voltage and the resulting excessive blinking and reduced lamp life, this practice is an outgrowth of the activities of the local I.E.S. chapter's lighting and wiring section.

Early fluorescent lighting installations in Kansas City were frequently troubled, after 800 to 1,000 hours, with lamps that "blinked" or failed to start. In almost all such cases circuit voltage was found to be near the low end of the 110-125-volt range of rated voltage and the lamps would not strike. Instead they blinked repeatedly and in a few hours destroyed themselves, particularly if lamps had already operated about 1,000 hours.

In cases of trouble involving blinking lamps it was often necessary not only to replace the damaged lamp but also the starter. Otherwise, damaged contacts on the starter would ruin the new lamp. Until the booster technique was developed, therefore, these related difficulties resulted in (1) a high lamp renewal rate and (2) a tendency on the part of customers to discredit fluorescent lighting—and indirectly the electrical industry



CONNECTIONS for small transformer used as auto-transformer to boost fluorescent lamp circuit voltage

Rebuilding Old Transformer Bushings

Portland General Electric Company, Portland, Ore., has a number of early type transformer bushings such as the G.E. Type S I, Form C, 73,000 volts, 400 amp. Such oldtime bushings were first put out with solid top and bottom, non-removable. Other types followed, with solid top but removable base flange. Finally, in the modern types, both top and bottom are removable.

In the case of the oldtimers expansion and contraction due to weather would eventually cause a leak at the top and oil would siphon up through and deteriorate the compound. There was no remedy other than to send the bushing to the factory for complete rebuild, until the maintenance department developed a method of repair that has since proved very satisfactory.

In the case of bushings with both solid top and bottom both ends are sawed off with a hacksaw. The stem is then thoroughly cleaned, as are the insulators. For the repair, new-style top and bottom rings are cast and also new terminal top and bottom flanges. Next, a copper thimble is spun conforming to that in a new-

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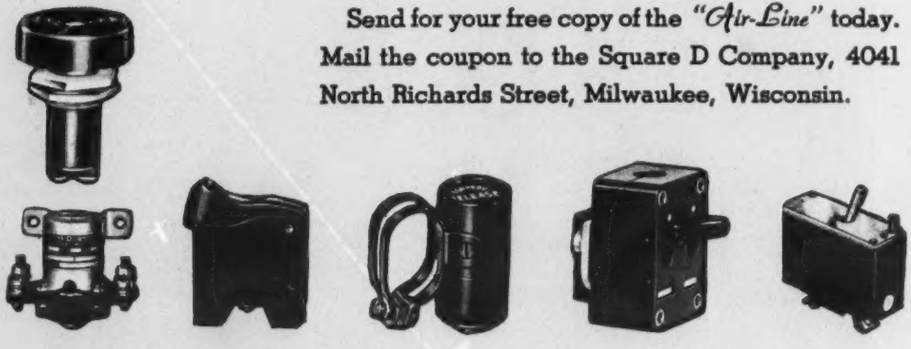

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style bushing. The next step is to reinsulate with new Empire cloth, put on a copper shield, cotton tape, and put together as in a new assembly, filling with new compound (latest type, oil-resisting).

Bushings having a solid top and removable bottom are handled in the same way, only the top being cut off.

Great care should be exercised in checking the porcelain, putting in new when there is the least sign of defect. What is aimed at is a rebuilt bushing as good as new, so it does not pay to put in any questionable porcelain parts. If the porcelain in an old bushing is all defective, then try to salvage at least the stem, and vice versa. Put such salvaged materials into stock and eventually build up new bushings from them.

At pre-war prices a new bushing would cost approximately $200. These rebuilt bushings, practically as good as new, are turned out at a cost of $35 to $40 for labor and $5 to $10 for materials.

•

3-Position Disconnect on 132-Kv. Transformer

By A. PALME
Power Transformer Engineering Department, General Electric Company, Pittsfield, Mass.

Six single-phase power transformers, each rated 22,500 kva. self-cooled and 30,000-kva. forced air-cooled, have been shipped by General Electric to a large Western city to supply the municipal loop system with an additional 180,000 kva. from two three-phase banks. Power to the banks is supplied from a steam station at 13,200 volts and is stepped up by the transformers to 132,000-Y volts.

It was requested that a disconnect be attached to each transformer unit on the 132-kv. side, by means of which it would be possible to :(1) Isolate the transformer from the loop. (2) Connect the transformer to the loop. (3) Ground the transformer and high-voltage cable. This required an oil-immersed, single-pole, three-position disconnect for 132 kv., mounted near the top of each 23-ft.-high transformer tank.

To comply with the standard test voltage of 277 kv., the switch and its own oil tank were of unprecedented size. Each switch in its steel casing weighs 11,000 lb. and holds 1,660 gal. of oil, making the complete switch weigh nearly 12 tons. (The whole transformer unit, ready for operation, weighs 91 tons).

An interesting requirement affecting the design of this switch was the stipulation that the construction must be "earthquake-proof." This precluded any separate support for either the switch or the operating handle. The entire weight of the switch had to be braced against the transformer tank and the switch handle was mounted on a bracket, extending from the transformer trucks. In case of a seismic disturbance, transformer, switch and handle will therefore move as one unit.

More Steam—How?

17. Conclusions*

By ALFRED IDDLES
Application Engineer
The Babcock & Wilcox Company

My conclusions from tests of numerous boilers and many other observations on similar units are as follows:

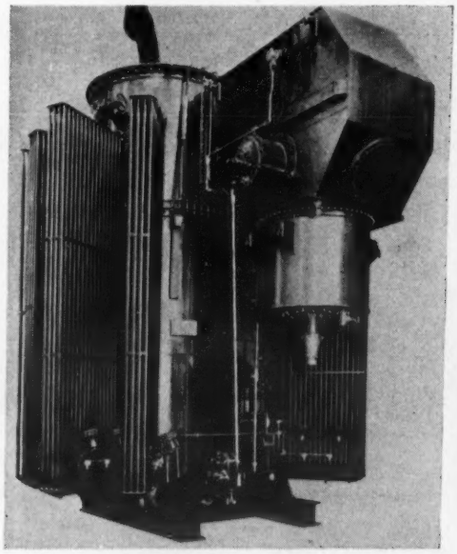
1. Exceptionally careful supervision of control equipment is necessary if the plus or minus 10 deg. usually specified is obtained from the usual superheat control arrangement.

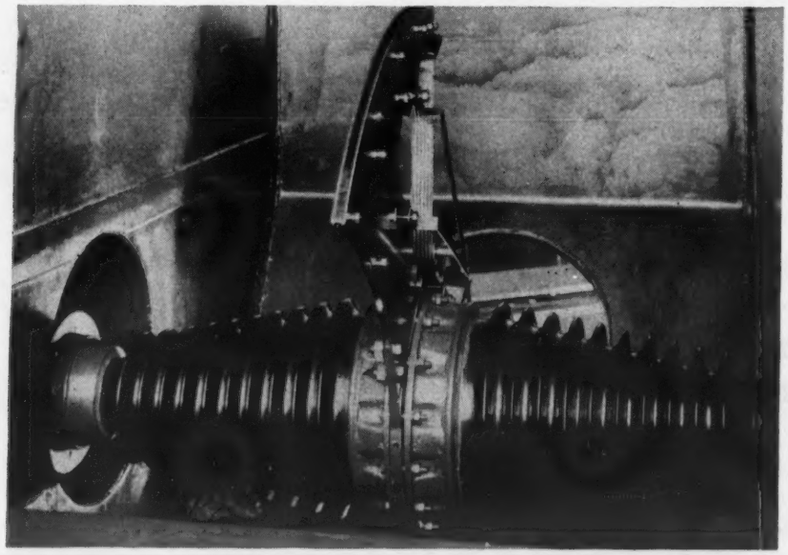
2. Designers must be accurately aware of operating conditions if a proper choice of equipment is expected. Feedwater cannot change widely without affecting superheat.

3. Designers and operators must recognize the wide variation in conditions that usually exist in boiler furnaces and either arrange to control these conditions within narrow limits or specify and obtain especially flexible control apparatus if constant steam temperature is desired.

There are variables of stored heat and effects of load cycles and time which cannot be overcome or anticipated, and therefore the accuracy of temperature control in most cases is less than what some people expect and in some cases could not under any circumstances be obtained by design or control of operation.

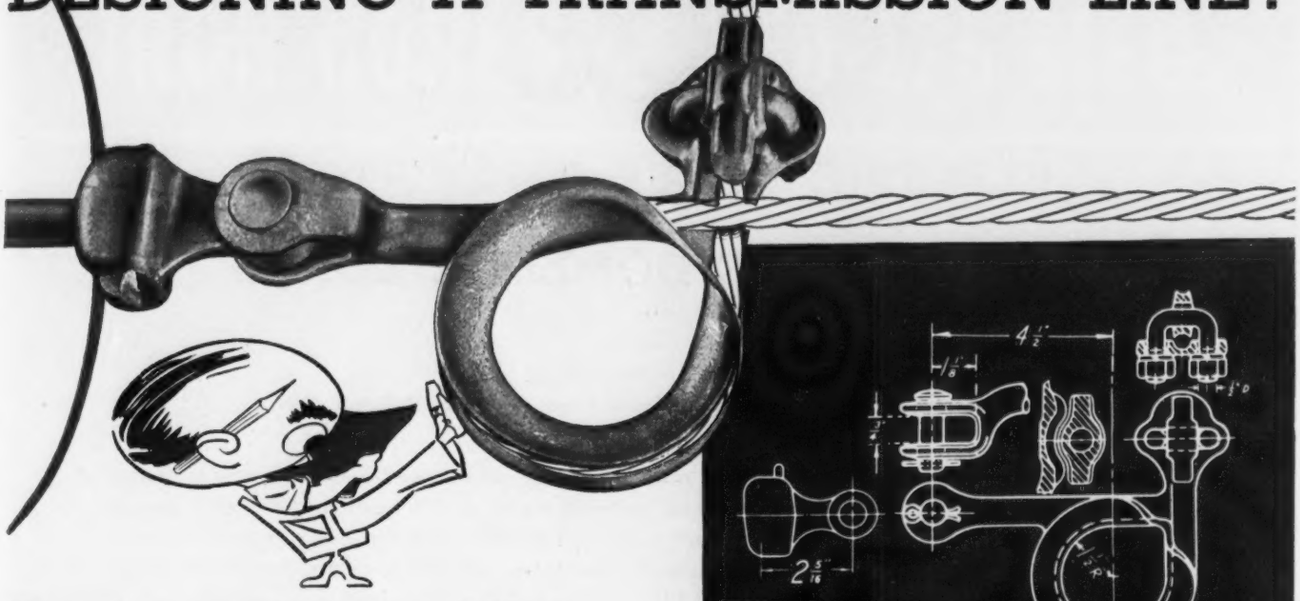
* This article concludes a series which began in the May 16, 1942, issue of "Electrical World," adapted from author's talk "What the Operator Wants to Know" to Steam Power Division, A.S.M.E., Metropolitan Section, March 25, 1942.





EARTHQUAKE-PROOF ASSEMBLY of oil disconnect and grounding switch for 132-kv., 30,000-kva. single-phase transformer; cable entrance provided (left); 132-kv. oil-immersed disconnect viewed from transformer side, showing porcelain rotor and part of switch contact (right)

DESIGNING A TRANSMISSION LINE?



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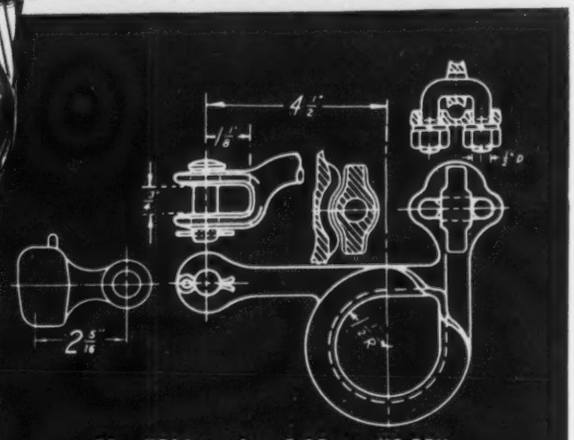
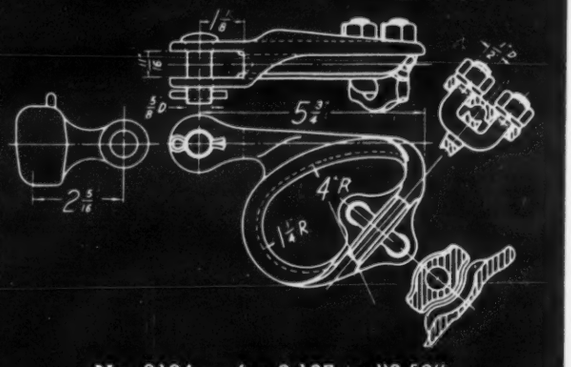
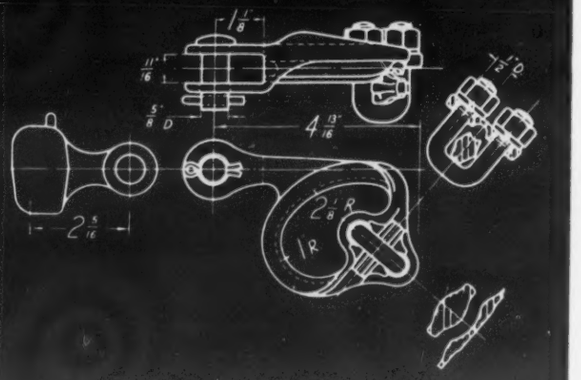


No. 7511 — for 0.16 to "0.55" cable diameter including armor ribbon if used.



No. 2104 — for 0.187 to "0.50" cable diameter including armor ribbon if used.



No. 2102 — for 0.128 to "0.375" cable diameter including armor ribbon if used.

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GUIDE FOR
ELECTRIC METER APPLICATION
SINGLE-PHASE DOMESTIC LOADS

By R. A. CALDWELL
Meter and Transformer Engineer, Interstate Power Company, Dubuque, Iowa

Accompanying table gives the "maximum economic limit" of kilowatt-hours per month which can be measured economically by various ampere sizes of 115-volt, single-phase meters when used on an average domestic-customer service. For 230 volts, three-wire service double the kilowatt-hours shown and apply values in the table as before. Remove meter when usage exceeds kilowatt-hours shown in table.

Meter Type	Year First Mfrd.	"Maximum Economic Limit"—Kilowatt-Hours per Month													
		50	60	95	110	125	140	190	220	280	375	450	550	1,000	1,300
		Meter Rating in Amperes													
Duncan															
M & M-1	1912	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
M-2	1915	.....	5	.....	10	.....	15	.....	.....	25	.....	.....	50	.....	.....
MD	1926	.....	.....	5	.....	.....	.....	.....	.....	15	.....	25	.....	.....	.....
MF	1934	.....	.....	.....	.....	5	.....	.....	.....	.....	15	.....	.....	50	.....
G. E. Co.															
I & I-8	1903	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
I-10	1910	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
I-14	1914	.....	5	.....	10	.....	15	.....	.....	25	.....	.....	50	.....	.....
I-16, I-20	1927	.....	.....	.....	5	.....	.....	.....	10	15	.....	.....	25	.....	.....
I-30	1937	.....	.....	.....	.....	.....	5	.....	.....	.....	15	.....	.....	.....	50
Sangamo															
H	1911	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
HC	1928	.....	.....	.....	5	.....	.....	.....	10	15	.....	.....	25	.....	.....
HF	1934	.....	.....	.....	5	.....	.....	.....	10	15	.....	.....	25	.....	.....
J	1939	.....	.....	.....	.....	.....	5	.....	.....	.....	15	.....	.....	.....	50
W. E. & M. Co.															
Round & A	1899	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
C	1906	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
OA	1910	.....	5	.....	10	.....	15	.....	.....	25	.....	.....	50	.....	.....
OB	1924	.....	.....	5	.....	.....	.....	.....	.....	15	.....	25	.....	.....	.....
CA	1932	.....	.....	.....	5	.....	.....	.....	.....	15	.....	.....	.....	50	.....
Ft. Wayne															
K	1899	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
K-1, 2, 3, 4	1908	5	.....	10	.....	.....	15	20	25	.....	.....	50	.....	.....	.....
K-5	1914	.....	5	.....	10	.....	15	.....	.....	25	.....	.....	50	.....	.....

NOTES

1. Avoid installing a meter which has a "Maximum Economic Limit" of *less than* twice the maximum monthly kw.-hr. expected to be used.

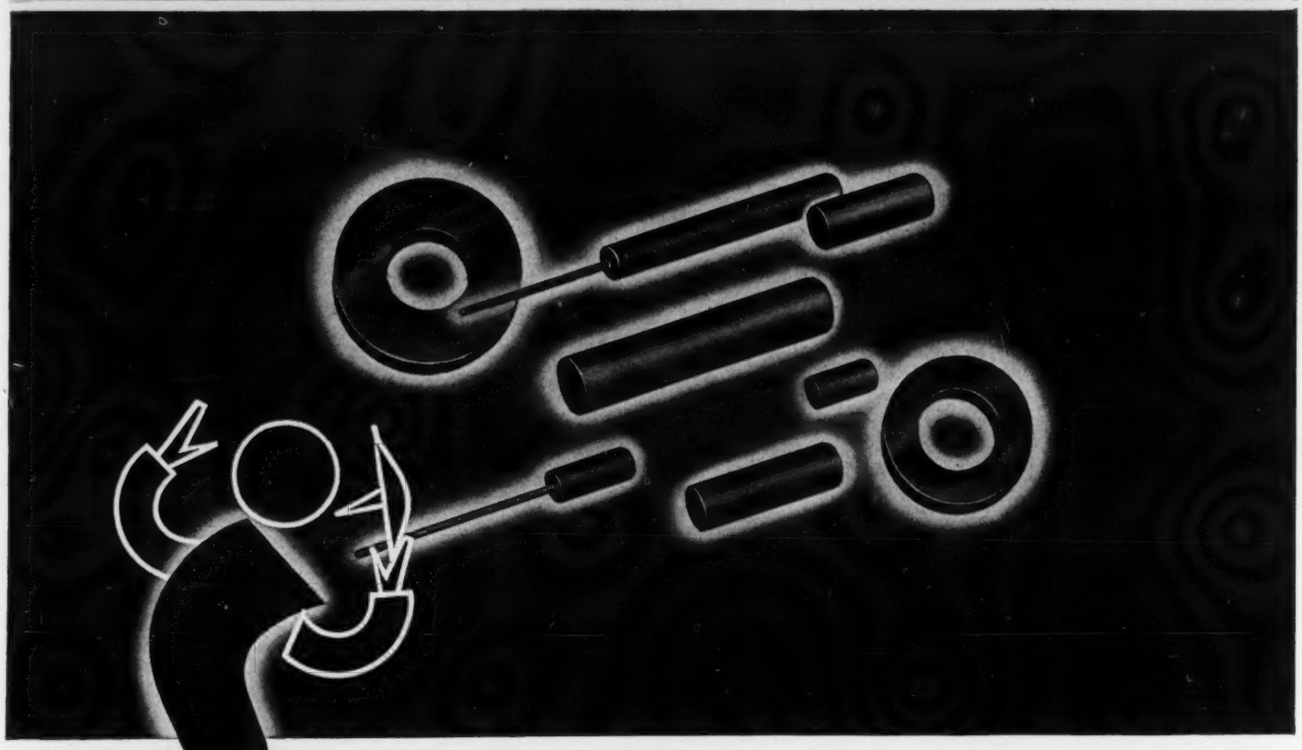
2. Avoid installing a meter which has a "Maximum Economic Limit" of *more than* five times the maximum monthly kw.-hr. expected to be used.

3. When the customer's monthly kw.-hr. consumption is below one-tenth of the "Maximum Economic Limit" for the meter, it is recommended that the meter be replaced with a smaller size.

4. The table constitutes a rough summary of many sources of available data and is based on a load factor of approximately 7.6 percent for domestic customers. Special cases, commercial and power customers should always be given special consideration.

In such cases the table is useful as a means of comparing various types of meters.

IRON CORES *for* 150-175 MEG.



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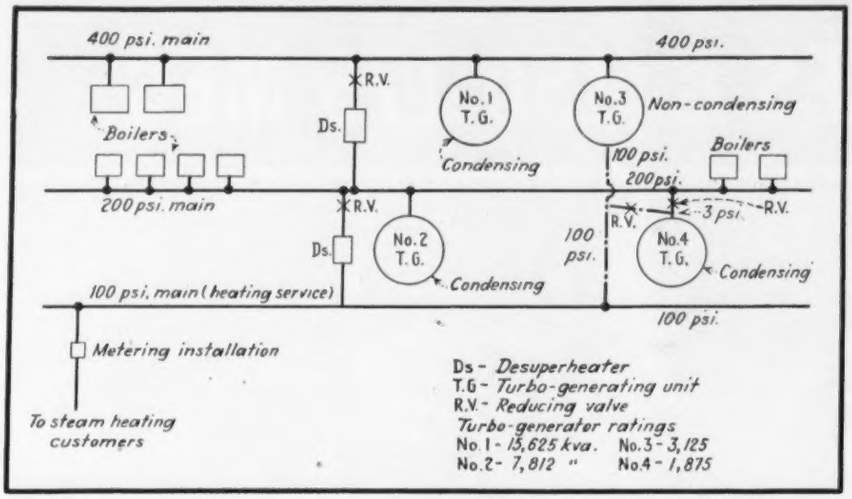


SIMPLIFIED DIAGRAM of steam mains and generating units to provide for economical operation of electrical and heating services

Flexible Layout for Dual Service Plant

To enable an Eastern central station supplying steam service in addition to electricity to important load centers near the plant to achieve economical operation, a flexible layout of mains and connections is an essential feature of the system. Originally the plant was equipped with boilers operating at 200 psi., four 400-hp. and two 600-hp. units being installed with convection type superheaters which superheated the steam to 460 deg. F. Following the acquisition of the heating load an installation was made of two 400-psi. 150,000-lb. per hour boilers with extended surface economizers, convection type superheaters and water walls on the sides and back of the boilers. The superheat was 700 deg. F. The heating steam leaves the plant at 100 psi. and 400 deg. F.

The turbo-generating equipment consists of four units. No. 1 is rated at 15,625 kva., is supplied from the 400-psi. main and operates condensing. No. 2, a 7,812-kva. machine, is supplied from the 200-psi. main and runs condensing. No. 3, a 3,125-kva. non-condensing unit, is supplied from the 400-psi. main and exhausts at 100 psi. into the heating main. No. 4, a condensing machine of the back-pressure type, is supplied with steam at 3 psi. through reducing valves in the 200-psi. and 100-psi. piping as shown in the diagram. Connections also are provided between the 400-psi. and 200-psi. mains and from the latter to the 100-psi. heating main as shown, through reducing valves and desuperheaters.

The above arrangement enables the 100-psi. heating main to be supplied from the non-condensing turbine (No. 3) and from the higher pressure mains according to the prevailing conditions of load and weather. At full rating the back-pressure turbine delivers 120,000 lb. of steam per hour to the steam heating mains. The customer demand may reach 220,000 lb. of steam per hour during cold weather for parts of the day, requiring a "make-up" of 100,000 lb. per hour from either the 200- and 400-psi. mains. The heating demand may drop to 30,000 lb. per hour in the night and 3,000 lb. in summer. Under normal conditions the plant runs as a base load station, purchasing peak energy from an interconnected system.

No. 3 unit is run as much of the time as the heating system demands its exhaust steam, its electrical output being in a sense a by-product of the steam service. The magnitude of the electrical load on the station requires long-hour operation of the 15,625-kva. unit (No. 1) during the year, this machine consuming about 10 lb. of steam per kilowatt-hour at its best loading range. Unit No. 2 has a steam consumption of about 12.5 lb. per kilowatt-hour. The 400-psi. boilers are more efficient than the 200's and are used for base load service as much of the time as practicable.

The outgoing heating steam is metered at the plant, and in order to obtain accuracy in measuring flows ranging from as low as 3,000 to a maximum of over 200,000 lb. per hour three meters of different capacities are used and so arranged that a combination of any two metering lines may be used. All condensate is returned to the plant deaerating heaters by electrically driven pumps with float-controlled starters, and B.t.u. credits are given for a portion of the return.

In 1941 the station generated 115,940,150 kw.-hr. and purchased 48,997,400 kw.-hr. The maximum system load was 38,600 kw. The coal consumed totaled 88,360 tons (of 2,000 lb. each) and the fuel rate for electrical energy produced was 1.20 lb. per kw.-hr., allowing for coal burned for steam heating supply.

•

Transformer Fusing*

3. Salvage and Repair of Fuse Links

By H. L. LOWE
Ebasco Services, Inc., New York

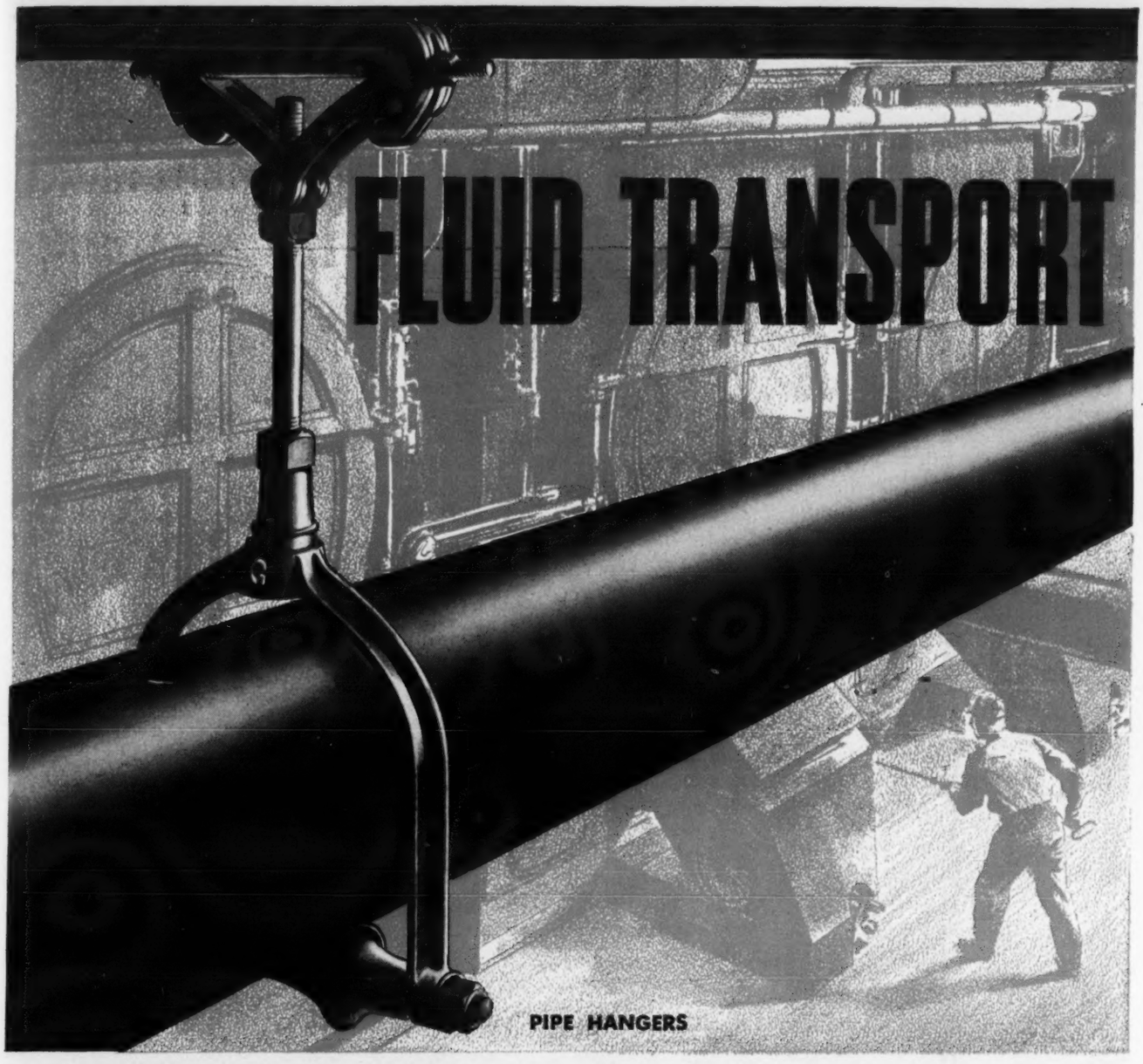
In anticipation of the possible shortage of critical materials it may be advisable to arrange for salvage of blown fuse links, which, if necessary, can be refitted with new fuse elements by local operators. This activity may be incorporated in a general program of reclamation of materials to prevent waste. Some preliminary experimental work will probably be necessary before a satisfactory reuse of fuse link parts will be possible.

Replacement of fuse elements may, of necessity, involve the adaptation of fusible metals which are available locally. Tin and silver seem to be the principal metals employed by the majority of manufacturers, but a few experiments by operators may indicate that lead and other less vital metals and alloys might perform satisfactorily as substitutes.

Fuse elements require only small quantities of vital materials and they have critical design characteristics. So that as long as supplies are available, it seems advisable to purchase them from manufacturers. If supplies become exhausted or transportation becomes difficult the task of making fuses or repairing them locally may be forced upon operators.

The simplest type of fuse which can be reconditioned locally is prob-

*This is the third of a series of articles which began in December 12, 1942, issue of "Electrical World."



"THE 17TH FLOOR IS CALLING FOR MORE HEAT". To distribute comfort in the form of steam or hot water to hundreds or thousands of radiators calls for experienced piping engineering to compensate for such factors as weight, pressures, exposures, expansion and contraction.

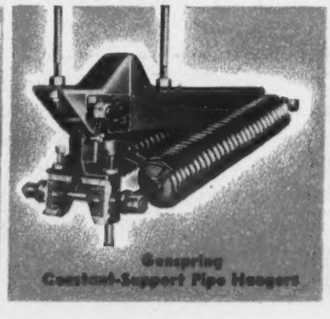
The supplying of heat through a maze of "branches" to every nook and corner of a building is a job for Grinnell FLUID TRANSPORT. As fabricators and manufacturers Grinnell supplies the connecting links which convert a pile of pipe into a complete heat distribution system.

For new war construction, or maintenance and repair of existing piping, call Grinnell Company, Inc., Executive offices, Providence, R. I. Plants and offices throughout the United States and Canada.

GRINNELL

WHENEVER **PIPING** IS INVOLVED

Automatic Sprinkler Systems


Genspring Constant-Support Pipe Hangers

Pipe and Tube Fittings

Prefabricated Piping

ably one originally made by overlapping two halves of the fuse element and soldering them together. In this type of fuse the operating characteristics are fairly easy to control. Overcurrent flowing through the link generates heat in the fuse element, causes the solder to melt and the two halves, held under tension, to pull apart.

One company has successfully reconditioned this type of fuse element in the following manner. The solder used for the junction of the two halves of the fuse element must have the same melting temperature as that used by the maker whose fuse it is desired to duplicate or recondition. This can easily be determined by test. Samples taken from a batch of fuses some time ago were tested. The solder was found to be a 40 percent tin and 60 percent lead mixture.

•

Truck Ladder for Lamp Changes

A simple form of truck ladder, used principally in making lamp changes, has been designed and built by the Puget Sound Power & Light Co., Northern Division, Everett, Wash. The actual cost does not exceed $25.

The ladder is an ordinary wooden one with holes through the side members at the base through which a rod is run, carried by supports fastened to the top of the truck in front. This gives a hinged mounting. A strut hung from the top rung and free to swing when the ladder is raised is then seated in a socket on the rear end of the truck platform.

Clicks Make Register Checking Easier

Clicks, heard and felt, are a great help in counting revolutions. Apparently the counting function of the mind responds more readily to such audible and tactile stimuli than to visual ones. Advantage is taken of this pecularity of perception in making rough check of demand register load indicator deflection in the meter laboratory of the Philadelphia Electric Company.

Depending on the type of register, a given number of revolutions of the watt-hour meter shaft will produce full scale deflection of the demand indicator on the register. This is merely a check on the operation of the indicator, not on its absolute accuracy. The usual method is to set the register or a number of them in a single or multiple jig with gears engaging the register drive or drives in simulation of the watt-hour meter rotation. These gears are rotated manually by means of a crank and gearing to give proper number of revolutions of the worm wheel. A given number of turns of the crank should result in full scale deflection of the demand indicator. And here is where the clicks come in. A small dog is set in the crank circle so that each turn is felt and heard by the operator. Each click records itself in its numerical sequence in the mind of the operator without any particular mental effort at counting.

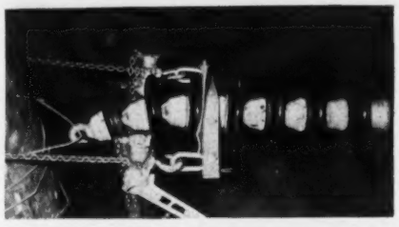
•

Rig Pulls Slack in Insulating String

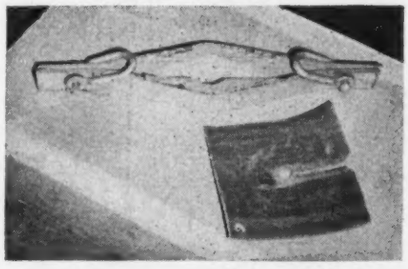
Always a tough rigging job for transmission towermen, particularly on short spans, is that of pulling enough slack in a string of dead-end disk insulators to engage the hook with the dead-end strain plate. Frequently some form of "grapevine hitch" is applied to the string of insulators, but almost invariably the hitch skews the disks around so that whatever slack has been pulled in is absorbed between the disks, leaving the towerman nearly as bad off as before.

What appears to be an easy way to do the job was used by the Nebraska Power Company on dead-end insulator strings consisting of 16 disks 10 in. in diameter—an awkward and heavy load to handle on a tower.

The scheme is simple. A split yoke, fastened at the outer ends with clevises, is clamped around the string a few disks out from the tower end, as shown in the illustration. A split piece of fiber belting is inserted between the yoke and the porcelain of the disk to protect against shipping. Hooks of two light-weight chain



YOKE AND HOIST RIG simplifies job of dead-ending short transmission spans



YOKE AND PAD are basic elements of simple dead-ending rig

hoists are fastened in the clevises and the other end of the chains to the tower arm. By taking up the two hoists at the same time, slack is pulled out of the conductor. The end disks are then freed of tension and the hook can be engaged in the strain plate without difficulty. The rig was developed for construction work and is obviously not intended for hot line work.

Yoke used by the Nebraska Power Company was made from a couple of old 2 x $\frac{3}{8}$-in. transformer hangers. It is 26 in. long over all. Braces were bowed over the center 16 in. of their length to give a $2\frac{1}{2}$-in. offset in each brace to fit around the hub of the insulator. A small stiffening and/or bearing plate was added to the bowed portion of each plate to offer a flat surface to bear upon the disk, or, more correctly, on the pad that separates the yoke and the disk.

Construction men estimate that it takes about five minutes to dead-end a string of insulators with this rig.

Protect YOUR turbines with this oil that helps keep our

BATTLEWAGONS BLASTING!

THE OIL that lubricates the powerful turbines aboard a battlewagon is as vital as the powder that sends the big 16-inch shells hurtling through space.

Entrusted with this important job aboard many battleships, aircraft carriers, destroyers, cruisers and other U. S. Naval units, is the new rust-preventive Shell Turbo Oil . . . lubricating not only heavily loaded main and thrust bearings but also reduction gears which must run at terrific rubbing speeds and under heavy pressures.

Shell Turbo Oil can survive these extreme operating conditions because it has *all 3* characteristics necessary to the proper lubrication of modern turbines:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Call in the Shell man now for full details.

RUST-PREVENTIVE
SHELL TURBO OIL
A name to Remember
SHELL

This is a composite photograph of many members of the "Bomber Building" army who individually helped save 100,000 man-hours or more in America's war factories.

Here's the Latest News about the "BOMBER BUILDERS"

HELPING with all their might to speed war production through better lighting, 2907 lighting men in all parts of the country have signed the pledge reproduced on the opposite page. Every day this army grows stronger as new names are added.

Already these 2907 men, recruited from the staffs of electric service companies, electrical jobbers, contractors and manufacturers of lighting equipment, as well as from General Electric's own lighting experts, are credited with adding over 21 million man-hours annually to America's war production.

Each of these men, known as "Bomber Builders", received a Silver Bomber lapel button upon signing the pledge. And each of them has as his goal the winning of the Gold Bomber pin, which is awarded to every man who "builds a bomber", that is, every man who helps save 100,000 man-hours in war factories through lighting improvements. As of December 7, a total of 139 "Bomber Builders" had won the right to wear the Gold Bomber pin. And many others are well on their way toward that goal.

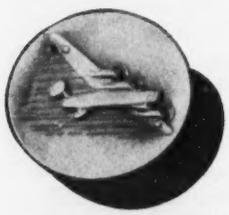
The lighting industry has a right to be proud of these men—all of them. General Electric is glad to publish this tribute to these Wartime Lighting Counsellors who have pledged their time and effort toward one goal —"using light to help win the war."

G-E MAZDA LAMPS

HERE'S THE HONOR ROLL OF "BOMBER BUILDERS"...DECEMBER 7, 1942

EACH OF THESE MEN HAS HELPED SAVE OVER 100,000 MAN-HOURS OR MORE:

JOHN R. ALLEN, Electro Manufacturing, Chicago
J. M. ASHER, Benjamin Electric Manufacturing, Philadelphia
WM. J. ASHTON, Pacific Div., G-E
H. ATKINSON, Graybar Electric, Houston
F. K. BAILEY, Muntz & Lea, Chicago
R. H. BAKER, Mill Power Supply, Charlotte, N. C.
A. G. BIRD, Graybar Electric, Lansing
L. J. BISCHOF, Atlantic Division, G-E
J. G. BLOOD, G. E. Supply, Buffalo
E. G. BRADLEY, Madison Electric, Detroit
LYN BRIGHT, Elliott-Lewis Electric, Philadelphia
J. W. BROWN, Atlantic Division, G-E
E. A. BUEL, Continental Division, G-E
JOHN T. BURDICK, Madison Electric, Detroit
J. A. BUREL, Matthews Electric Supply, Birmingham
W. WALLACE BURKE, Public Service Co. of N. H., Manchester
R. P. BUSCH, Empire Division, G-E
L. J. CAMPBELL, Southeastern Div., G-E
JOHN R. CANNING, Elliott-Lewis Electric, Philadelphia
J. W. CARPENTER, Elliott-Lewis Electric Philadelphia
T. G. CARROLL, Wakefield Brass, Detroit
R. B. CHIPMAN, JR., Continental Division, G-E
I. E. CHRISTMAN, Alleghany Div., G-E
C. A. CLAYTON, J. M. Clayton Co., Atlanta
G. A. CLOSE, Wheeler Reflector Co., New York City
HARRY B. COAX, Empire Div., G-E
E. E. COLEMAN, Midwest Div., G-E
W. COLEMAN, Madison Electric, Detroit
OLCOTT N. COLLAR, Commonwealth Edison, Chicago
J. R. COLVILLE, JR., Atlantic Division, G-E
H. W. CONKLIN, Continental Div., G-E
RAYMOND W. CORWIN, Benjamin Electric Mfg., Philadelphia
J. M. COSTELLO, Atlantic Div., G-E
R. W. COULS, Madison Electric, Detroit
H. G. CRAFT, Mill Power Supply Charlotte, N. C.
C. L. CROUCH, Buffalo Niagara Electric, Buffalo
GENE D'ANGELO, Philadelphia Electric, Philadelphia
ROBERT D. DAVEY, Consumers Power, Adrian, Mich.
A. W. DAVIS, Continental Div., G-E
GOMER F. DAVIS, Buckeye Div., G-E
C. J. DETMERS, Madison Electric, Detroit
E. F. DIBELIUS, Atlantic Division, G-E
GEO. E. DYGERT, Madison Electric, Detroit
T. C. ERRINGER Northern Division, G-E
FRANK C. FLETCHER, Graybar Electric, Minneapolis
W. R. FLOUNDERS, Continental Division, G-E
C. K. FULLERTON, Madison Electric, Detroit
E. E. FOURNIER, G. E. Supply, Springfield, Mass.
HENRY GALLIEN, JR., New York Power & Light, Troy, N. Y.
R. D. GLENNIE, G. E. Supply Corp., Buffalo
E. G. GOLDSMITH, Empire Div., G-E
M. W. GORDON, New York Power & Light, Troy, N. Y.
K. A. GOTTSCHALK, Cleveland Electric Illuminating Co., Cleveland
L. M. GRAWEMEYER, The Miller Co., Ardmore, Pa.
H. R. GREENE, Daybrite Ltg. Inc., Cleveland
G. L. GRUENWALD G. E. Supply, Wichita, Kansas
DUPONT GUERRY, Huntington & Guerry, Greenville, S. C.
JAMES E. HAMILL, Atlantic Div., G-E
PETER B. HANSEN, Graybar Electric, Minneapolis
WILLIAM N. HARRISON, Philadelphia Electric, Philadelphia
E. J. HARVEY, G. E. Supply, Buffalo
S. H. HAZLETON, JR., Pacific Div., G-E
G. R. HOFFMAN (Deceased), Graybar Electric, Reading, Pa.
HOWARD HOLIDAY, F. D. Lawrence Electric Co., Cincinnati
P. R. HOLMES, Continental Div., G-E
J. H. HOWARD, Huntington & Guerry, Greenville, S. C.
R. S. HUNTINGTON, Huntington & Guerry, Greenville, S. C.
A. H. JONES, Madison Electric, Detroit
R. E. JORDAN, Empire Division, G-E
F. E. KEENER, Southeastern Div., G-E
G. F. KEHOE, G. E. Supply, Buffalo
I. KERMODE, G. E. Supply, Cleveland
C. N. KNAPP, Southeastern Division, G-E
L. J. KNEIL, Madison Electric, Detroit
ROBT. A. KOBLIZK, Parr Electric, Newark, N. J.
FRED J. KRAMER, Columbus & So. Ohio Electric Co.
K. C. LARABEE, Continental Div., G-E
PETER LEE, Graybar Electric, New Haven, Conn.
J. J. LIESKE, JR., Graybar Electric, Grand Rapids
H. G. LINDER, Graybar Electric, Rochester, N. Y.
A. E. LONGMATE, Pacific Div., G-E
HARLOW LOOMIS, Philadelphia Electric, Philadelphia
J. L. LUND, Cleveland Electric Illuminating Co., Cleveland
LESLIE D. LYON, Consumers Power, Jackson, Mich.
HARRY M. MacFARLANE, Madison Electric, Detroit
JAY MANN, Electro Manufacturing, Chicago
T. R. MACAULAY, Graybar Electric, Flint
R. A. MATTHEWS, G-E Supply Corp., Columbus
JAMES E. McGIRR, Cuny & Guerer, New York City
JAMES T. MEADOR, Southern Electric Service, Charlotte
FRANCIS H. MEIER, Consumers Power, Muskegon
H. M. MERRICK, Continental Div., G-E
LEE W. MORGAN, Potomac Edison, Hagerstown, Md.
R. G. MORISON, Atlantic Division, G-E
FRANK C. MUELLER, Cleveland Electric Illuminating Co., Cleveland
V. NEMEROFF, Electro Manufacturing, Chicago
C. E. NOONAN, Graybar Electric, Buffalo
C. M. OLDACH, Elliott-Lewis Electric, Philadelphia
L. J. O'BRIEN, Graybar Electric, Milwaukee
G. E. PARK, Southeastern Division, G-E
MARK D. PELTON, Empire Div., G-E
RAY E. PERRY, Kansas City Power & Light, Kansas City, Mo.
E. J. PERKINS, Holophane Co., Boston
ARTHUR J. POPKIN, Holophane Co., New York City
D. W. PRIDEAUX, Northern Div., G-E
EDWARD M. REID, Benjamin Electric Manufacturing, Des Plains, Ill.
JESSE RHOADS, Graybar Electric, Baltimore
RAY RIDDLE, Madison Electric, Detroit
LOUIS A. ROBINSON, Wheeler Reflector Co., Newark, N. J.
E. J. ROMMEL, Toledo Edison, Toledo
J. A. ROYCE, Graybar Electric, Rochester, N. Y.
J. R. RUTLEDGE, Huntington & Guerry, Greenville, S. C.
J. W. RYAN, JR., Atlantic Division, G-E
HARRY M. RYAN, Shepherd Electric, Baltimore
R. S. SCHOFF, Michigan Division, G-E
CARL J. SCHROEDER, Giffels & Vallet, Detroit
F. M. SHOLDERS, Graybar Electric, Kansas City, Mo.
L. P. SMITH, G-E Supply, Columbus,
C. M. SNYDER, New England Div., G-E
MICHAEL SPISAK, Madison Electric, Detroit
W. T. SWEENEY, Atlantic Division, G-E
JOHN A. TAYLOR, Blackstone Valley Gas & Electric, Woonsocket, R. I.
FRED TELDER, G-E Supply, Kalamazoo
A. S. TURNER, JR., Continental Div., G-E
HUGH A. TUTTLE, Madison Electric, Detroit
ROY W. VERSHURE, Madison Electric, Detroit
HERBERT B. VOLK, Graybar Electric, Buffalo
S. E. WADDILL, G-E Supply, Norfolk, Va.
J. EDWIN WATKINS, New England Division, G-E
J. F. WATKINS, Atlantic Division, G-E
CHARLES WEBB, Perry Mann Electric Co., Greenwood, S. C.
P. J. WEBB, Graybar Electric, Rochester, N. Y.
W. S. WHEELER, Graybar Electric, Philadelphia
GEORGE B. WILLIAMS, G-E Supply, Philadelphia
F. C. WILSON, Kansas City Power & Light, Kansas City
GARY E. WISE, Holdenline Co., Cleveland
W. V. WIVEL, Continental Division, G-E
P. M. WOOD, Continental Division, G-E
W. F. YEAGER, Continental Div., G-E



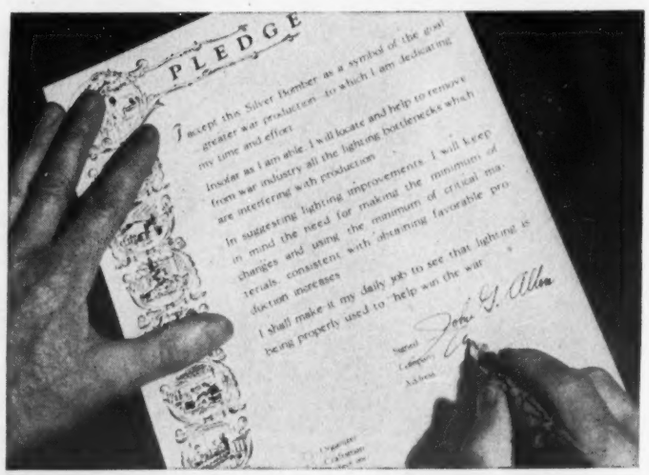
SILVER BOMBER LAPEL BUTTON

GOLD BOMBER PIN

Of the 2907 lighting men who had signed the pledge at the right by December 7, 1942, the 139 men listed above have already helped save 100,000 man-hours or more and are wearing the Gold Bomber pin. In addition to these, lighting men in all sections are fast approaching that goal.

* * *

THIS IS THE PLEDGE that 2907 lighting men have signed indicating their determination to help war plants speed production with better lighting.


PLEDGE
I accept the Silver Bomber as a symbol of the goal
greater war production to which I am dedicating
my time and effort.
Insofar as I am able, I will locate and help to remove
from war industry all the lighting bottlenecks which
are interfering with production.
In suggesting lighting improvements I will keep
in mind the need for making the minimum of
changes and using the minimum of critical ma-
terials consistent with obtaining favorable pro-
duction increases.
I shall make it my daily job to see that lighting is
being properly used to help win the war.

GENERAL ELECTRIC

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Disaster Ads Help Troubled Customers

Customer service advertisements with a new twist have been distributed by Wisconsin Public Service Corporation to company district or division managers for insertion in local newspapers when the occasion warrants. Both of the advertisements, shown, are what the company calls "trouble shooter" ads and are intended to follow closely in the wake of storms when the customer's equipment or the customer himself may be endangered, either due to fallen wires or flooded basements.

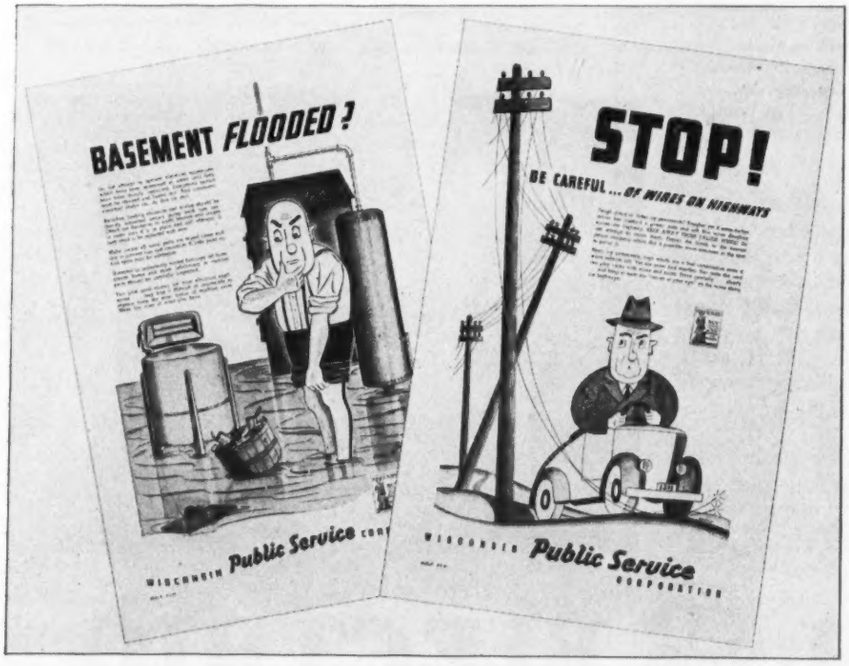
To the customer whose basement has been flooded by a sudden storm the company's advertisement offers sound advice on what to do about the electrical appliances that may have suffered. Such timely suggestion to customers is a real service when a few hours delay in taking the proper action may be the difference between salvage and complete destruction of an irreplaceable appliance. The advertisement says:

> Do not attempt to operate electrical appliances that have been immersed in water until they have been thoroughly inspected. Damped motors must be cleaned and baked dry. Any competent dealer can do this for you. Switches, heating elements and wiring should be inspected before going back in service. Check insulation in water heaters and ranges to make sure it is in place and still efficient, it may need to be replaced with new. Wipe metal parts clean and dry to prevent rust, a little paint on bad spots may be advisable. Unsealed bearings, oil line grease boxes and other moving parts should be inspected. You paid good money for your electrical appliances—may find it difficult to replace even the most minor working parts. Make the most of what you have.

Winter ice storms, in northern Wisconsin as elsewhere, are no joke. For the safety of its customers immediately following such storms this winter company advertisement will warn customers as follows:

> Sleet, icy pavements, high winds are a bad combination even if wires seldom fall. Yet the same bad weather that coats the road can play tricks with wires and poles. Drive carefully—slowly and keep at least the "corner of your eye" on the wires along the highways. Keep away from fallen wires! Do not attempt to move them. Report the break to the nearest power company office and if possible leave some one at the spot to patrol it.

In its instructions to division and district managers on the use of these advertisements in time of local stress the company warns that fast action is necessary to keep them timely. In the case of the flood advertisement it is best not to run it if disaster hits only a few homes—much better in these cases to have some one visit or phone the people affected.

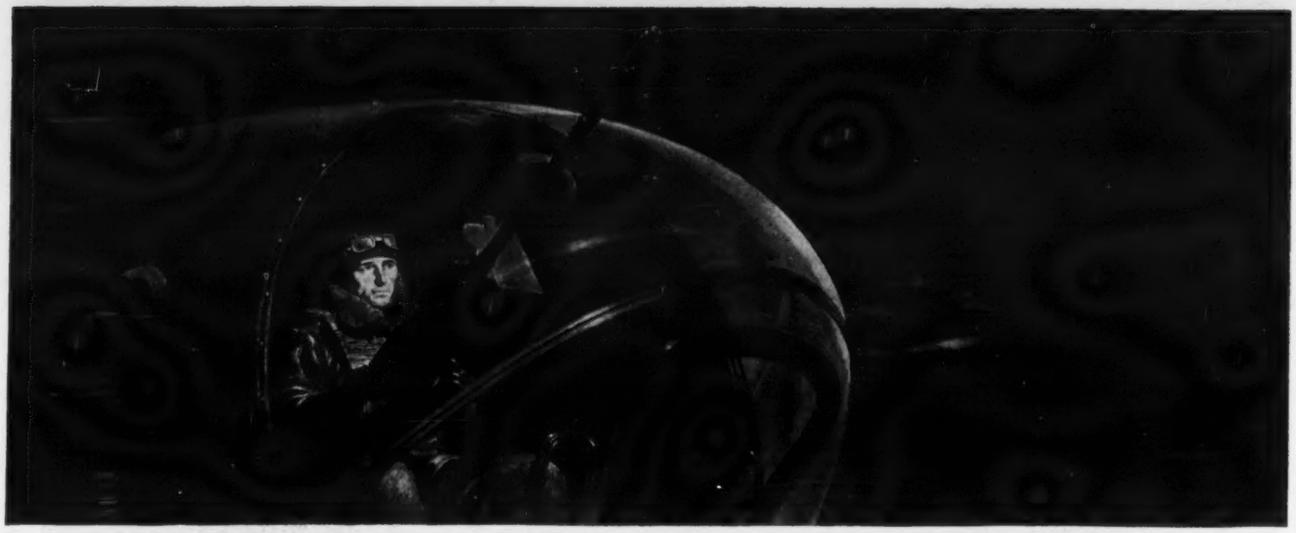


SAMPLE ADVERTISEMENTS of the "trouble shooter" type help customer when storms endanger electric appliances or the customer himself

•

Meeting Street Light Dimout Requirements

Considerable ingenuity was exercised by the Tacoma City Light Department in meeting dimout requirements. They have about 8,000 street lights all told. Of this number, some 4,000 are old-style glass globes with ventilated top. These were dimmed by installing an asbestos shield. This shield, conical in form, was made over a conical metal form having slits in the top as shown by the accompanying illustration. Asbestos was wrapped about the form, the edges being overlapped and glued, and top and bottom then trimmed. By pass-



"UNTIL I COME BACK"...

We're over 20,000 feet now (the coffee's frozen in the thermos) and that's the Zuyder Zee below. We must be halfway across Holland.

Funny thing what happens to a fellow . . .

Those are the same old stars and the same old moon that the girl and I were looking at last Christmas.

And here I am—flying 300 miles an hour in a bubble of glass, with ten tons of T. N. T.

Somehow—this isn't the way I imagined it at all, the day I enlisted. Don't get me wrong—sure I was sore at the Japs and the Nazis—but mostly, it was the thrill of the Great Adventure.

Well, I know now—the *real* reasons—why I'm up here paying my first call on Hitler.

It's only when you get away from the U. S. A. that you find out what the shootin's really about and what you're fighting for.

I learned from that Czech chap in London. The refugee, the nice old fellow who reminded me of Dad except for the maimed hands. I was dumb enough to ask about it. "I got that," he said, "for writing a book the Nazis didn't like . . ."

Then there was the captured German pilot who screamed and spit when Izzy Jacobs offered him a cigarette . . . how do fellows get that way?

And that crazy Polish pilot—the fellow who rammed the Messerschmitt. After the funeral I learned what was eating him. Seems as how he had a sister in Warsaw who had been sent to a German Officers' Club . . .

I hope to hell Hitler's home tonight . . . light and wind are perfect.

Yes, sir, I've met 'em by the dozens over here—guys warped by hate—guys who have had the ambition beaten out of them—guys who look at you as if you were crazy when you tell 'em what America is like.

They say America will be a lot different after this war.

Well, maybe so.

But as for me, I know the score . . . you learn fast over here. I know now there's only one decent way to live in this world—the way my folks lived and the way I want to live.

When you find a thing that works as good as that—brother, be careful with that monkey-wrench.

And there's one little spot—well, if they do as much as change the smell of the corner drug store—I will murder the guy.

I want my girl back, just as she is, and that bungalow on Maple Avenue . . .

I want that old roll-top desk of mine at the electric company, with a chance to move upstairs, or quit if I want to.

I want to see that old school of mine, and our church, just as they are—because I want my kids to go there.

That's *my home town* . . .

Keep it for me the way I remember it, just the way I see it now—until I come back.

KELVINATOR

Division of Nash-Kelvinator Corporation, Detroit, Michigan

Published in the belief that here at Nash-Kelvinator we carry a double responsibility —not only to build the weapons for victory but also to build toward the kind of a future, an American *future, our boys will want when they come back.*

★ Reprints of this Advertisement will gladly be sent you on request ★

STREET LAMPS painted in rotating jig to comply with dimout orders

ing a knife blade down through the slits in the form the shield was provided with tabs at the top.

In installing the shield, it was necessary to take off the cap. Then the shield was folded and inserted in the globe from below and far enough so that the tabs could be bent over to hold the shield in place, after it had been spread out inside the globe. The lower edge of the shield then came below the filament of the lamp.

They also have about 3,000 bracket lights, mostly of 100 to 250 cp. These were dimmed out with an inverted cone of fish paper sprayed with aluminum paint to weatherproof it. Where not practicable to use this kind of a cone, the top half of the lamp was painted, using Arco "Infray" (infra-red reflecting) paint.

In applying this paint, a special rig was set up by which the painting operation could be carried on with speed. A door motor with reduction gear was mounted on a bench with the end of the shaft of the reduction gear projecting over the edge. On the end of this shaft a sort of socket or cup of rubber was mounted, hollowed out so as approximately to fit the large end of the lamp bulb.

In front of the cup was mounted a narrow board, hinged at the bottom. This was fitted with a coiled spring so as to be drawn inward toward the cup. Inserting a lamp between the board and the cup, with the base against the board, the pull of the spring would hold the lamp against the cup with sufficient pressure so that the lamp would turn with the cup, at about 40 r.p.m. The operator then held a brush loaded with paint against the revolving lamp and did a good paint job quickly.

•

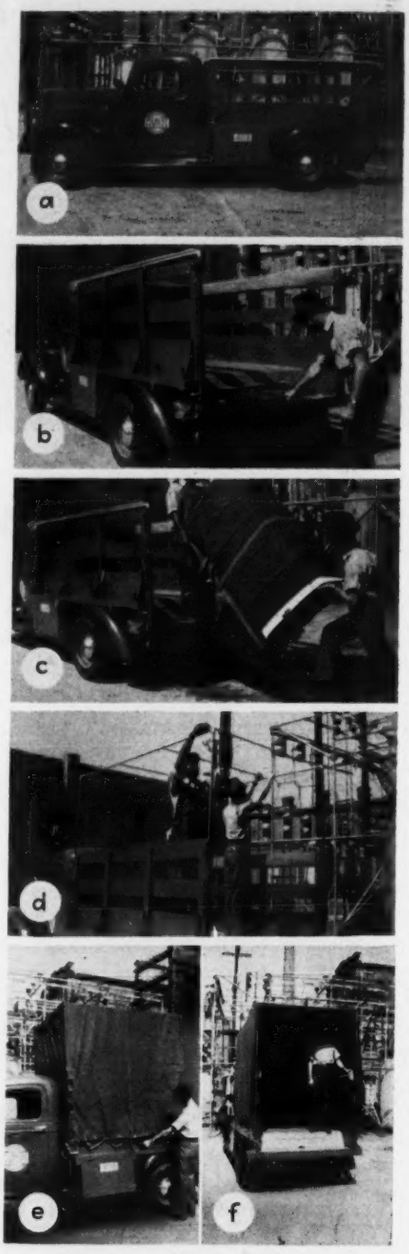
I.A.E.I. Booklet on Appliance Care

Care and repair of electrical appliances to maintain them in safe operating condition for the duration while replacements and parts are impossible or difficult to obtain is the subject matter of a 16-page pamphlet, "Electrical Safety in War Time," recently published by the Public Relations Committee of the International Association of Electrical Inspectors.

An excellent compilation of instruction and advice, the pamphlet treats of proper maintenance of electric ranges, toasters, grills, flatirons, vacuum cleaners, percolators, cords and cord sets, portable lamps and washing machines. Included also are discussion on electric shocks, how to avoid them, instruction on replacement of fuses and advice on the possible hazards of makeshift wiring. The pamphlet is available at small cost to utilities and others for distribution to customers and clients.

ELECTRICAL inspectors' association publishes pamphlet on maintenance of electrical appliances

Versatile Appliance Delivery Truck



Even though sales of new ranges, refrigerators and other heavy appliances will soon be only a memory, it still is necessary once in a while to move these pieces. And some day deliveries of new merchandise will start again. These are the reasons for printing these pictures of the locally designed delivery truck body used by Durham (N. C.) Public Service Company. The truck looks like any other (a). But it has a ramp (b) nested under the floor up which heavy appliances are pulled (c) on a hand truck. Then if it looks like rain the cover frame is raised (d), the tarpaulin is extracted from a box on the side of the truck, stretched over and tied down (e) and the load is protected from the weather (f).

Introducing

The New

Monitor

THERMALOAD V

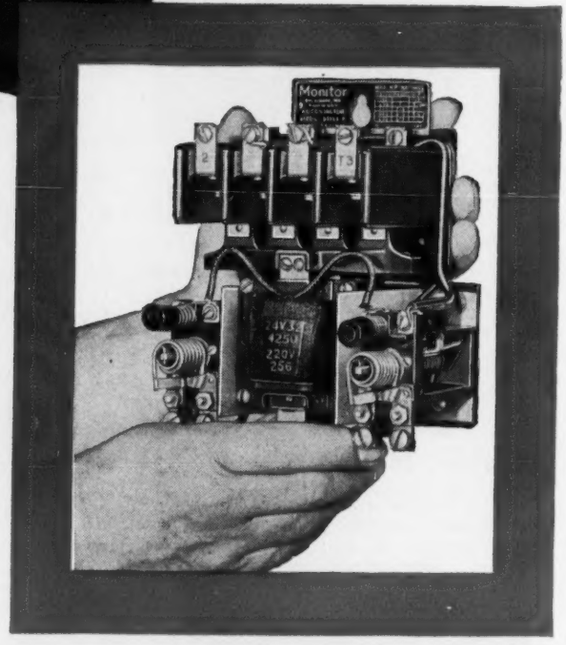
SOLENOID STARTER

Here is a solenoid starter that gives you the kind of protection you need. Because into this sturdy, compact unit, is built a feature that has proved its worth over years of service in larger Monitor installations —a feature that Monitor originated—the Monitor Compensated Thermal Overload Relay. Extremes in ambient temperature will not effect its performance! The trip *always* occurs in the same time at a given percent overload. Full overload protection for your motor is assured regardless of installation characteristics.

Other features include: Vertical, Straight-line Design . . . . Resilient, Shock-proof Mounting for quiet operation . . . . Double-Break, Silver Contacts . . . . Easily-Interchangeable Coils. And—Monitor quality construction throughout—your assurance of longer, more satisfactory performance.

For original equipment and for replacement—specify the starter that meets today's needs—the Monitor Thermaload V.

For further details and delivery dates, write us today.



5¾ ins x 5¼ ins. x 4⅛ ins.

These small over-all dimensions indicate better, more compact design. They permit installation in smaller spaces. Available in five sizes—1.5 to 7.5 H.P. 110 to 550 V (A.C.) Fully approved by Underwriters.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

NEW EQUIPMENT

Voltmeter

Designed to measure surge voltages caused by corona and surface discharges in motors, generators and cables, new elec-

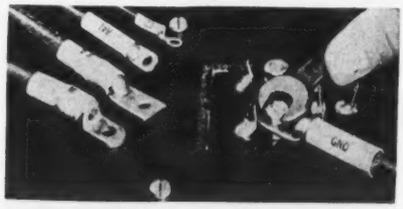
Electronic crest voltmeter, weighs 23 lb., has vibration-resistant movement; can be supplied marked and calibrated for any of the following scale ranges: 0-10,000 volts; 0-20,000 volts; 0-30,000 volts. **General Electric Co.**, Schenectady, N. Y.

tronic crest voltmeter is suitable for both laboratory and production testing. Having a self-contained battery power supply, the device may be used in areas where no electric power is available.

•

Marker, Insulator

Short lengths of extruded plastic tubing are designed to serve as insulators of terminal connections and as wire markers. Smooth inside surfaces are said to permit quick application over wires and lugs.



Plastic wire markers; also serve as insulators; available in colored tubing with either black or yellow symbols in A.S.T.M. sizes from No. 9 to ⅜ in. I.D. **Irvington Varnish & Insulator Co.**, 6 Argyle Terrace, Irvington, N. J.

Oscilloscope

"Model 555" oscilloscope uses a 5-in. cathode-ray tube operating on 2,000 volts; housed in black, non-corrosive steel case, 14 x 12 x 19 in., with carrying handle. **Radio City Products Co., Inc.**, 127 W. 26th St., New York.

Designed to meet requirements for extended frequency measurements, new cathode-ray oscilloscope operates from standard 115-230-volt, 50-60-cycle alternating-current power supply. Permissible input voltage to amplifiers is 600 volts and direct to deflection plates 500 volts, rms. Input impedance is 3 megohms. Voltage gain is approximately 275 times and sweep frequency is from 40 cycles to 750 kc. in ten uniformly linear steps.

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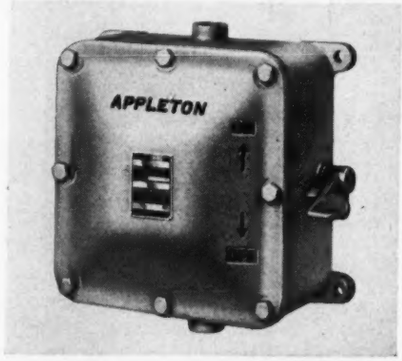
Switch

For general use and motor circuits, Underwriters' approved safety unit of the "Unilet" line is built in a heavy malleable



"FLS" explosion-proof, dust-tight, non-fusible switch; 2- and 3-pole, 30 and 60 amp., up to 575 volts a.c. and 600 volts d.c. **Appleton Electric Co.**, 1701-1729 Wellington Avenue, Chicago.

housing, is manually operated and does not require the interlocking features on the cover and switch handle.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Storage Battery

For stand-by and telephone use, storage battery has a white jar composed of non-critical vitrified ceramic and has a highly

"Vitrabloc" batteries, with rubber replaced by non-critical ceramic; available on A-3 priority. **Philco Corp.**, Storage Battery Division, Trenton, N. J.

glazed surface inside and out. Like glass, "Vitrabloc" does not absorb moisture, it is said, and is unaffected by acid. The unit is provided with spray-proof funnel vents.

•

Resistance Box

"Type DR" D.C. resistance decade has resistance ranges of 0.9 to 999,999 ohms total. **Industrial Instruments, Inc.**, 156 Culver Ave., Jersey City, N. J.

Housed in rubbed walnut case, resistance decade has guaranteed accuracy of one percent each way from zero error. All coils are bifilar-wound on ceramic tubes, oven-baked and protectively-coated. Switches have self-cleaning multi-blade phosphor-bronze spring wipers.

•

Terminals

Interchangeable test-lead terminals. **The States Co.**, Hartford, Conn.

Suitable for testing laboratories, new line of terminals features interchangeability for the same set of leads. The terminals, such as straight, tapered, split, lug and

A CENTURY OF SERVICE

When, at midnight on December 31st the clock chimes twelve, and we pass into the year 1943, so Hubbard and Company will enter its second century in business. We think it is excusable to believe that such survival and notable growth could only be possible for an institution built on solid foundations with a steadfast policy of honest service in all its ten decades of existence.

That past generations of "Hubbard" men have done a splendid job is attested by the Present. We owe all to their courage, devotion and inspiration. We of the Present cannot rest on their laurels. We must turn our eyes to the Future.

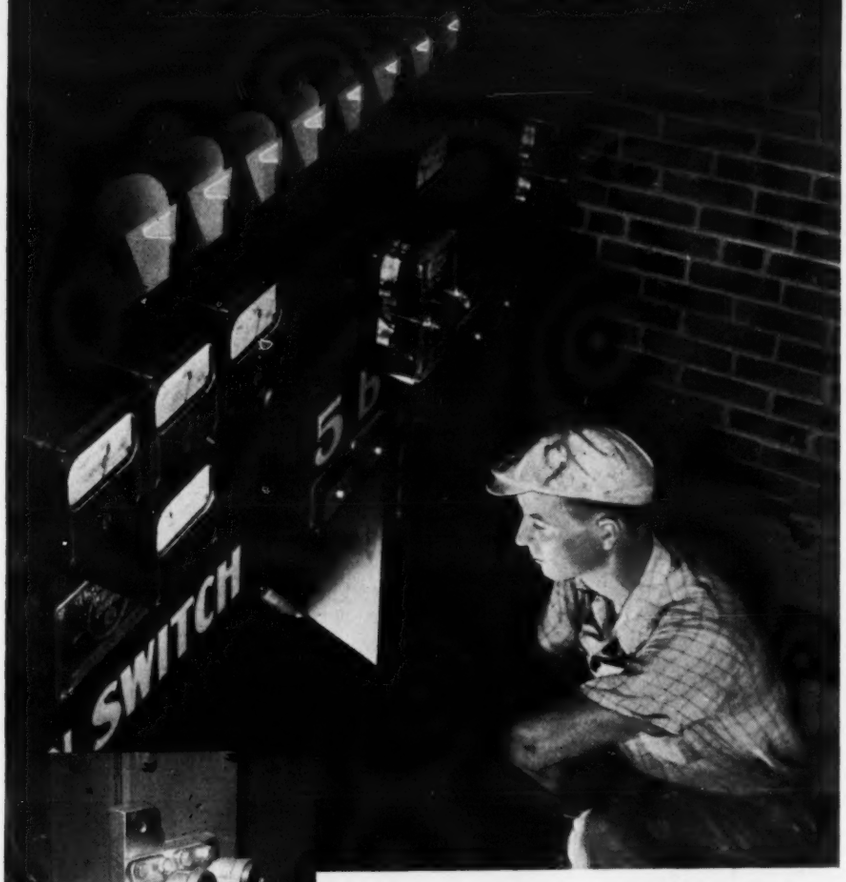
On this, the advent of our "century in business," we thank you, our friends, for your ever loyal support and pledge that we of the Present "Hubbard" generation will keep faith with our predecessors of the past 100 years.

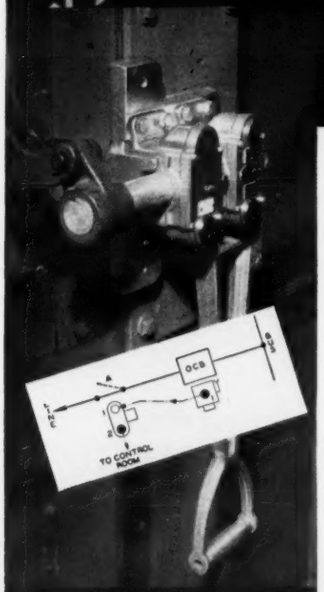
May our wishes for your Peace and Happiness bear fruit in 1943. Sincerely and Gratefully,

HUBBARD & COMPANY

Does YOUR Switch Room employ an

INVISIBLE CREW?





3-Key indoor spade handle type B-927 "BENDIX-CORY" INTERLOCK employed for protecting Transfer Bus.

SAFEGUARDING the lives of your Switch Room Crew has always been important. Today, with men *and* equipment irreplaceable, certain protection for *both* becomes imperative.

How secure such protection? Put "BENDIX-CORY" INTERLOCKS to work. These important members of the Bendix "Invisible Crew" *eliminate* fatal errors . . . *prevent* access to, and use of, high voltage equipment until proper precautions have been taken.

Note the application of "BENDIX-CORY" INTERLOCKS illustrated . . . it is one of hundreds of different adaptations which might well be employed in your plant. Write today for full information and suggestions on various Interlock systems of protection.

MARINE DIVISION
One Hanson Place, Brooklyn, N. Y.

Products of the Marine Division are important members of "The Invisible Crew" — precision instruments and controls which 25 Bendix plants from coast to coast are speeding to world battlefronts.

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

clamp types, may be screwed either into the end or the side of the insulated sleeve. Cable material may be conserved inasmuch as one set of leads may be used for connection to a variety of binding posts by simply changing the terminals.

TECHNICAL LITERATURE

NEUTRAL GROUNDING DEVICES — A proposed A.I.E.E. standard applies to grounding transformers and to resistors, reactors, capacitors and combinations of these, when used for grounding the neutrals of alternating-current electric systems. Publication No. 32 may be obtained from American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.

MOTORS—How to get the most service out of old and new motors, "switching" motors from one job to another, and equipping old machines with new motors, are subjects discussed, together with considerable technical data on selection, application and maintenance of motors, in "Motor Fitness Manual." The 40-page illustrated publication GED-1017 can be obtained from General Electric Co., Schenectady, N. Y.

NON-DEAERATING HEATER—Recommendations on nomenclature, definitions, construction, ratings, accessories and a typical specification are contained in a standards publication, "Standards of the Non-Deaerating Heater Section," obtainable from Heat Exchange Institute, 90 West St., New York, N. Y.; price 75 cents per copy.

DISTRIBUTION SYSTEMS—Design, operation, characteristics and schematic diagrams of eight industrial distribution systems are included in booklet B-3152, "Industrial Plant Distribution Systems," available from department 7-N-20, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

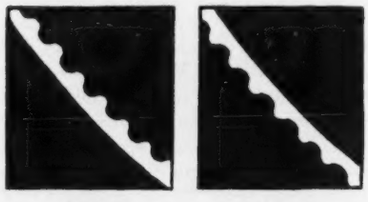
SWITCHGEAR—"Standards for Switchgear Assemblies" covers equipment such as switches, interrupting devices, control, metering, protective and regulating equipment with associated interconnections and supporting structures. It is A.I.E.E. Standard No. 27 and can be obtained from American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.; price 30 cents.

BLOW TORCH—For service and maintenance information a two-color wall chart shows labeled parts and gives lighting instructions and safety limits by illustrations. Copy of the chart, when requested by a responsible individual, will be forwarded by Turner Brass Works, Sycamore, Ill.

STANDARDS — Canadian Engineering Standards Association has issued the following standards: A56-1942 covers the material requirements only for round timber piles; C77-1942 applies to indoor oil circuit breakers for a.c. only, having interrupting capacities of 500,000 kva. or less and voltage ratings of 15,000 volts or less; also five additional sets of drawings, Nos. 2, 3, 4, 5 and 6, for insertion in Standard C83-1942—Pole Line Hardware. The two standards at 50 cents each and the five sets of drawings at 25 cents per set may be obtained from the C.E.S.A. headquarters, National Research Building, Ottawa, Ontario.

Saves maintenance

HERE'S THE DIFFERENCE



NEW **OLD**

New Westinghouse globes are of pressed glass construction. The outside is perfectly smooth while the inside is finished with a uniform pattern of rectilinear prisms, through which light rays are diffused horizontally. The result is a globe of brilliant and sparkling appearance that transmits light with maximum efficiency.

Again, Westinghouse engineers have made an outstanding contribution to street lighting efficiency. It's the new SMOOTH SURFACE globe—an exclusive Westinghouse development.

It has a smooth *outside* surface with rectilinear configuration on the inside for light diffusion. Its smooth surface retards the collection of normal dust and dirt, because there are no grooves to accumulate smoke and grease film. Rain readily removes dry dirt, and when washing is necessary, a damp sponge will do the job.

The newly designed globe not only relieves a maintenance problem, but has high photometric characteristics; uniform mechanical strength, and because it stays clean, maintains its light output over a longer period. The globe is available in two types — long and short. Both types are interchangeable with present Westinghouse Reflectolux glassware.

For more complete information on the new SMOOTH SURFACE globe, write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio.

Westinghouse *Lighting Equipment*

NEWS ABOUT PEOPLE

Pacific Gas Announces Sales Appointments

To fill gaps made by the calling of men into military service, the sales department of Pacific Gas & Electric Co. at headquarters in San Francisco has made the following changes:

Wayne Clark, administrative assistant to General Sales Manager O. R. Doerr, has been made merchandise manager to fill the vacancy made by the leaving of Capt. Arthur Miller. Gus Stricker becomes administrative assistant. R. I. Mendes, who has been connected with the company for a number of years, and who recently has been engaged in priority work in the purchasing department, moves to the general sales department.

•

▶ HENRY G. LAMB, who has had considerable experience in industrial safety work, has joined the staff of the American Standards Association as an assistant safety engineer. He will act as assistant to Cyril Ainsworth, assistant secretary of the A.S.A., who is in charge of the Association's safety program. Mr. Lamb was formerly identified with the Scott Paper Co., where he was responsible for organizing and putting into operation a safety program. He was previously identified with the Stone & Webster Engineering Corp. and the Liberty Mutual Insurance Co.

▶ VICTOR C. MOULTON, electrical inspector, Mountain States Inspection Bureau, Denver, Colo., was recently elected president of the western section, International Association of Electrical Inspectors. He was secretary-treasurer of the Rocky Mountain chapter. A graduate of University of Colorado in 1912 in electrical engineering, Mr. Moulton worked for Westinghouse until 1917 and after service in the War and other occupations, again went with Westinghouse in 1924. Later he worked for Southern Colorado Power Co. in Pueblo as commercial engineer and in 1930 joined Mountain States Inspection Bureau as electrical inspector.

•

P. W. Foster Assigned New Executive Duties

P. W. Foster, Jr., well known in the steam generation and processing industries, has been elected vice-president of the Foster Wheeler Corp., New York. Mr. Foster is well qualified to undertake the responsibilities of this new

position, having been with the corporation since its organization and before that with one of its antecedent companies.

A graduate of Princeton University, Mr. Foster joined the sales department of Power Specialty Co. in 1919 and, advancing consistently, he was placed in charge of the Boston office. Subsequently he was transferred to New York where he directed the industrial department, and more recently the steam generation division.

The Foster Wheeler Corp. was formed in 1927 through consolidation of Power Specialty Co. and Wheeler Condenser & Engineering Co.

▶ RALPH H. TAPSCOTT, president of Consolidated Edison Co. of New York, and recently designated its chief executive officer, has been elected president of the New York Steam Corp., succeeding the late David C. Johnson.

▶ E. I. SNYDER, formerly tax supervisor of the Portland (Ore.) General Electric Co., has been named assistant treasurer. LESTER G. PARK, formerly assistant treasurer and general auditor, is now in the Navy.

▶ JOE A. MORROW, since last June results engineer at the Byng station of the Oklahoma Gas & Electric Co., has been appointed assistant chief engineer of that plant. In this capacity he will assist Chief Engineer Ira B. Watkins in the responsibility for operating and maintaining the plant, taking charge in Mr. Watkins' absence, while continuing his present duties as to results and testing activities. Mr. Morrow, who has been connected with the Oklahoma utility for more than 18 years, served previously at Byng and also had a fine record of achievement at Horseshoe Lake station and Huey station.

▶ D. C. GREEN, for many years prominently identified with the public utility industry, was recently awarded the honorary degree of doctor of engineering by Purdue University "in recognition of his distinctive accomplishments as a constructive leader of great public utility and manufacturing enterprises and of his contributions to engineering and finance." Last March Mr. Green became chairman of the Cleveland Pneumatic Tool Co., Cleveland, Ohio, relinquishing the presidency of the Central Service Corp., Chicago, a service unit formed in 1938 to supervise the operating and management activities of the Utilities Power & Light Corp. Before heading the service company, he had been receiver of the Middle West Corp. Mr. Green was at one time president of the Middle West Utilities Co., central organization in the Insull utility system; served for several years as a vice-president of the Elec-

Send for your copy

OF THIS INDISPENSABLE ENGINEER'S TOOL

This Mitchell-Rand Wall Chart is a valuable tool for every electrical and design man. Measuring 22"x34" in size, it contains quick reference tables of electrical symbols, allowable carrying capacities of conductors, dielectric averages and thicknesses of insulating materials, mathematical tables, tap drill sizes, standards of varnished tubing sizes etc.

WRITE *TODAY*, ON YOUR BUSINESS LETTERHEAD . . .

WHY MITCHELL-RAND IS *"INSULATION HEADQUARTERS"*

- Our complete manufacturing and warehouse facilities—with large stocks on hand—permit us to render prompt service. Mitchell-Rand's prompt deliveries enable you to step up your war production schedules.
- Buying all your electrical insulating materials from one source of supply saves you valuable time and simplifies your buying.
- Mitchell-Rand's 53 years of experience can be of great value to you. Inquiries are invited on your electrical insulation requirements. You will receive prompt and intelligent service from an experienced M-R sales engineer.

MITCHELL-RAND GUIDE BOOK

Send for your FREE personal copy of our new, complete 44 page pocket-size Guide-Book—containing complete data, specifications and prices on all M-R products. This valuable book is a "must" for every engineer, purchasing agent, and manufacturing executive.

INSULATION M-R COMPANY EST. 1889

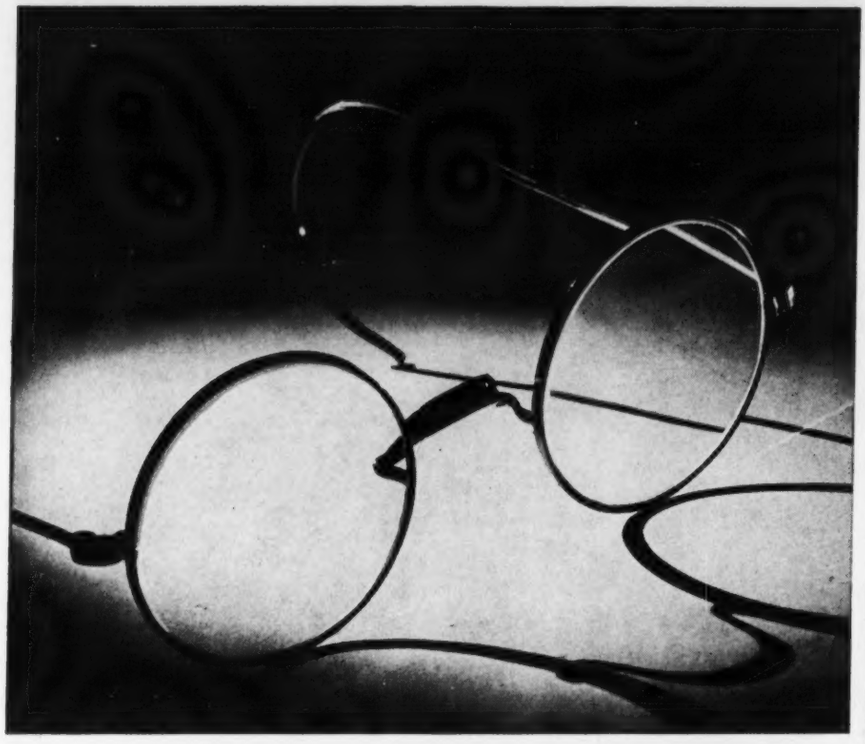
MITCHELL-RAND INSULATION CO., Inc.

51-B MURRAY STREET, NEW YORK, N. Y.

COrtlandt 7-9264

A PARTIAL LIST OF M-R PRODUCTS . . .

Fiberglas Varnished Tape and Cloth	Fiberglas Braided Sleeving	Fiberglas Saturated Sleeving and Varnished Tubing	
Insulating Papers and Twines	Cotton Tapes, Webbings and Sleevings	Asbestos Sleeving and Tape	Extruded Plastic Tubing
Cable Filling and Pothead Compounds	Impregnated Varnished Tubing	Varnished Cambric Cloth and Tape	
Friction Tape and Splice	Transformer Compounds	Insulating Varnishes of all types	Mica Plate, Tape, Paper, Cloth and Tubing



There will be FEWER OF THESE

Eyeglasses symbolize eyestrain. By reducing eyestrain through proper lighting, your war production can be increased both in quantity and quality. Fewer man-hours will be lost, fewer rejects will come off your production lines.

Silv-A-King offers a complete lighting service—fine equipment (either fluorescent or incandescent) plus skillful engineering to lay out your lighting installation for maximum effectiveness. Our ability to serve you well in lighting comes from 21 years of experience as industrial lighting specialists. A Silv-A-King lighting engineer is at your call wherever you are located.

Bright Light Reflector Company, Inc.,
1035 Metropolitan Avenue, Brooklyn, N. Y.

Write for new, 16-page Silv-A-King book:
"Light Is An Essential Production Tool"

A Few Typical Silv-A-King Users:
AC SPARK PLUG
GENERAL MOTORS
FISHER BODY
INTERNATIONAL HARVESTER
JONES & LAUGHLIN STEEL
PITTSBURGH PLATE GLASS
and many others

FLUORESCENT · INCANDESCENT
SILV-A-KING
EQUIPMENT

SILV-A-KING MAKES *Light* WORK FOR YOU

tric Bond & Share Co. in New York, and before assuming these duties in the East he had had a long period of service in the public utility industry in the West.

▶ HERBERT H. IDLE has been named secretary of the Arizona Edison Co., Inc. He had been Globe division manager and has been succeeded there by T. T. PARKER.

▶ B. J. BRAHENEY, central division auditor for the Oklahoma Gas & Electric Co., has been made division manager. He has been a member of the Oklahoma Gas organization for 18 years, the last twelve of which as auditor for the division of which he now assumes the managership.

▶ DR. ALBERT W. DAVISON, professor of chemical engineering and head of the industrial engineering curriculum at Rensselaer Polytechnic Institute, has joined Owens-Corning Fiberglas Corp. as scientific director of its research laboratories at Newark, Ohio.

▶ WALTER M. DICK, treasurer of the Westinghouse Electric Supply Co., has retired after forty years of service. He joined the company in 1901 in the accounting department at Pittsburgh, later becoming a traveling auditor in 1907 and chief field auditor in 1915. Mr. Dick is active on the technical advisory committee of the National Electrical Wholesalers Association.

▶ GEORGE A. MILLS has been assigned the duties of superintendent of power plants for the Central Power & Light Co., Corpus Christi, Tex., to succeed J. E. CRAVEN, resigned. Mr. Mills was formerly home office engineer. Mr. Craven joined the organization in 1926 as an engineer in the general office in San Antonio. He was transferred to San Benito as an operating engineer in 1933. Early in 1939 he became superintendent of power plants and was moved to the home office in Corpus Christi.

▶ DAN M. GALVIN has been appointed acting district manager of the Westinghouse Lamp Division's southwestern district, with headquarters in St. Louis, Mo. He assumes the managerial position formerly held by George B. Mackey, who is on leave of absence, having entered military service. Mr. Galvin has been connected with Westinghouse since 1930. He is a member of the Illuminating Engineering Society and the St. Louis Electrical Board of Trade.

▶ RALPH T. CHEESEMAN, designing engineer in the rectifier division, River Works, General Electric Co., Lynn, Mass., has been appointed designing engineer of the lighting division, succeeding Thomas G. Whyte, newly named assistant to the manager, in charge of

THE GLORY OF DEMOCRACY

THE sacrifices that are needed in order to win the war are apparent to us all.

The Treasury's appeals to buy War Bonds, the Government's pleas to conserve gas and rubber, the economies required to avoid inflation, the necessity of rationing many essential commodities—all these have become vital in the minds of our people.

Necessity has awakened us, not only to the size of the task before us, but to the fact that our future as a nation is at stake; and in characteristic fashion we-*all* are responding.

Our hearts speak, our purses are open wide; and regardless of creed, or color, or political convictions, our honest differences of opinion are being dissipated before the issue that confronts us.

This is the glory of democracy: that a man may think as he will, speak as he will, vote as he will, and worship God in his own way; yet in the hour of peril to the State, that which is for the greatest good of all is not only his most compelling thought but the strongest prompting of his heart.

In that hour his thought is no longer of himself but of his country; and it is as though his soul were crying out those memorable words of Plato: "Man was not born for himself alone but for his country."

BUY WAR BONDS

Thos. J. Watson, President

INTERNATIONAL BUSINESS MACHINES CORPORATION

STOP SHUTDOWNS!

Keep Motors and Generators Running at Peak Efficiency for Vital War Production

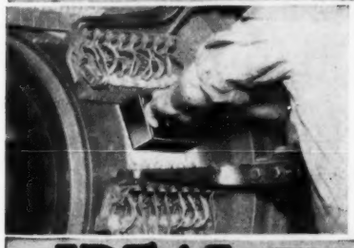
Running 24 hours daily—every day—is bound to raise havoc with all Motors or Generators, unless they are given periodic maintenance. IDEAL Products, as shown below, offer the *quickest, best* and *least expensive* means of maintaining electrical equipment without *shutdowns*. Over 17,500 Users.

IDEAL Commutator Cleaning Stone

Quickly Removes Excess Film

Inexpensive—you can't afford to be without it! A few seconds application periodically cleans away excessive deposits of dirt or brush material caused by heavy and continuous power loads. Doesn't cut commutator; doesn't clog. Helps to seat brushes as it cleans, increasing brush life. 5 sizes.

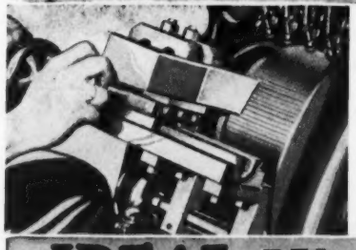
IDEAL Resurfacers



Keep Motors On the Job WITHOUT DISMANTLING

Quick, easy way to periodically smooth up Commutator and Slip Rings. Refinish to a smooth, highly polished surface in own bearings. No dismantling; no production delays. Use IDEAL Resurfacers periodically to keep Commutators and Slip Rings like new — eliminates production delays! Over 175 styles and sizes.

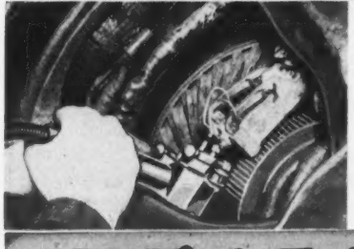
IDEAL Precision Grinders



True Up Commutators and Slip Rings In Their Own Bearings

If your Commutators and Slip Rings are badly grooved, scored, or out of round, this is the easy way to restore them to original efficiency, WITHOUT DISMANTLING. Mounts directly on the brush arms or frame, grinding is done at normal operating speeds under the machine's own power. 3 models.

IDEAL Mica Undercutters



For Undercutting High Mica

IDEAL Undercutters cut the hardest mica. Three Models: (1.) "Direct Drive", small, handy unit that undercuts without removing a single brush; (2.) "Universal", smallest most powerful undercutter on the market; (3.) "Shop Model", for large commutators.

Write for Literature on Complete Motor Maintenance Line

IDEAL COMMUTATOR DRESSER CO.
1021 Park Avenue Sycamore, Ill.
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd. Montreal, Quebec

engineering. Mr. Cheeseman joined the company in 1903 at Pittsfield, Mass., remaining until 1913 in the street lighting department, when he was transferred to Lynn. In 1916 he was assigned to the rectifier section of the lighting division, River Works, and was named designing engineer for copper oxide and tungar rectifier equipment.

•

Sylvania Announces New Assignments at Ipswich

R. G. Johnson has been appointed supervisor of personnel. Joseph F. Poor manufacturing superintendent and Dan W. Poor, Jr., supervisor of cost accounting at the Ipswich, Mass., plant of Sylvania Electric Products, Inc. Rene G. Maurette is named supervisor of product engineering, C. T. Baxter supervisor of quality, I. R. Schaller purchasing agent, R. B. Franklin supervisor of scheduling and raw materials, Arthur B. Rose supervisor of methods and Dr. Herbert Trotter, Jr., manager of the new products department at Ipswich.

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► CHARLES W. TAGGART, formerly manager of the Norwich (Conn.) Gas and Electric Department, has become associated with the Trimount Dredging Co., Norwich, specialists in electric dredging operations.

► R. E. MCDONALD has been appointed advertising manager of The Dunmore Co., Racine, Wis., to succeed R. B. Voelker, who will soon enter military service. Mr. McDonald formerly engaged in advertising work for Fairbanks, Morse & Co., Chicago, for a number of years.

► W. L. BUCHANAN has been appointed field manager of renewal parts sales of the Crocker-Wheeler Electric Manufacturing Co. with headquarters in the Chicago office. Mr. Buchanan's duties will consist of heading up all renewal parts sales and service in the field. By training and experience Mr. Buchanan is well qualified to handle his new responsibilities. He was instrumental in some of the early installations of automatic substations and in addition he is well known in the Chicago area, having been a service engineer for the Westinghouse company in that territory, specializing on commutation difficulties. In 1933 he was appointed appraisal engineer of the Missouri Public Service Commission and subsequently returned to Westinghouse as installation engineer of automatic substations for the IRT, New York, following which he became interested in steel mill work. He has been associated at various times with the

Mesta Machine Co., United Engineering & Foundry Corp., Republic Steel Co., Otis Steel Co., Youngstown Sheet & Tube Co., and more recently with Carnegie-Illinois Steel Corp., as maintenance engineer and subsequently as chief test engineer of the Gary Works.

▶ R. C. WIETERSEN has been appointed director of purchases for The Buda Company, Harvey, Ill. Mr. Wietersen has had extensive experience in the purchasing field and for the past two years was director of purchases for the National Supply Co., Springfield, Ohio.

▶ CHARLES J. OTIS has been placed in complete charge of purchases for the Ward Leonard Electric Co., Mount Vernon, N. Y.

▶ A. C. JOHNSTON, formerly manager of the Arvida Works, Aluminum Co. of Canada, has been appointed as manager of power generation for the company.

▶ W. E. GRIFFITHS has been appointed assistant manager of sales, flat-rolled products, Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Mr. Griffiths was formerly manager of the product development department.

▶ CHARLES E. HART has been elected president of the Chase Brass & Copper Co., Waterbury, Conn., to succeed FREDERICK S. CHASE, who is retiring from active work. Mr. Chase, who celebrated his eightieth birthday last July, had been connected with the Chase interests since his graduation from Yale in 1887. Mr. Hart was elected executive vice-president in 1938 and has been connected with the company since 1924. He practiced law in Waterbury and served as corporation counsel for the Chase Brass & Copper Co. two years before he became associated with that organization.

▶ L. W. TAYLOR has been appointed sales manager of the outside construction department of the Graybar Electric Co., succeeding D. C. GUEST, who is retiring. Mr. Taylor has worked in the outside construction department since 1937, when he was put in direct charge of rural line activities with the title of assistant sales manager of outside construction department. He started his career with Graybar at the Columbus House in 1927 and covered that territory as salesman until his transfer to Chicago in 1937. In 1939 he was made sales manager of the rural line department and in January, 1941, he was transferred to Washington, reporting direct to Vice-President Hessler. His new appointment brings him to New York. Mr. Guest has been 36 years in the industry, starting with the Western Electric Co. at Chicago in 1906.

TAKING care of tools is always good business. In times like these, when our Armed Forces need every tool that can be produced to keep a mechanized war rolling, it is doubly important to look after those you have.

The high quality of Klein equipment assures long life.

Take care of your pliers and wrenches—take care of your grips and climbers—take care of your belt and safety strap. If they're Klein's, you are fortunate in possessing equipment that is designed to give you the maximum in service. Proper care will assure your getting that service.

ASK YOUR SUPPLIER. *FOREIGN DISTRIBUTOR:* INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK

Since 1857

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO

What would you do if you were ordered to BLACKOUT tonight?

THROW THE SWITCH? LOSE PRODUCTION . . .

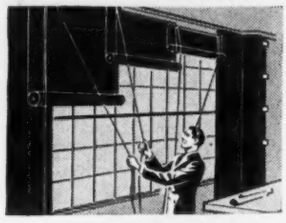
VALUABLE MAN-HOURS?

Don't risk it.

Install tested, inexpensive

CLOPAY BLACKOUT BLINDS

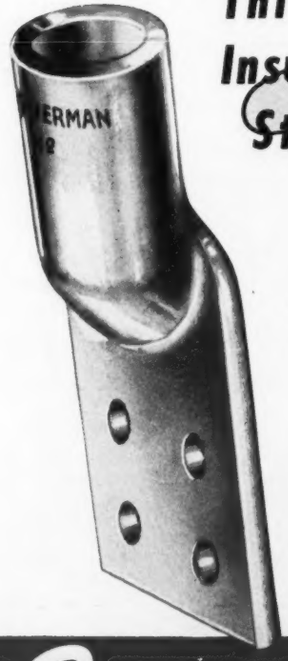
NOW!



Don't get caught by a sudden, nation-wide scramble for blackout materials that might take months to supply. Get ready now, for uninterrupted production during test blackouts or actual alarms. Do it quickly, *economically*, with CLOPAY Blackout Blinds. Safer, more convenient than paint. Raise and lower quickly. 1/7 the cost of opaque cloth of adequate quality. Made of tough "flame-proofed" crepe fiber. Used in many costal plants and institutions, in several government buildings.

Write for complete information and swatches of material.

CLOPAY CORPORATION
1263 Clopay Square, Cincinnati, O.



This Extra Deep Socket Insures Greater Mechanical Strength plus Higher Conductivity

Extra strength, to withstand any stresses — plus extra capacity to insure minimum IR drop! That's the combination that has made these Sherman Soldering Lugs the standard of the electrical industry.

Sherman Lugs are bright and clean, too, with no sharp edges or burrs — and the contact surfaces are FLAT.

Write for catalog which gives full specifications on a wide range of sizes and styles.

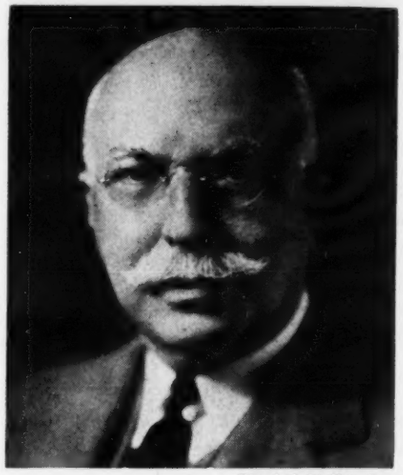
H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICHIGAN

Sherman **HEAVY DUTY SOLDERING LUGS**

OBITUARY

William S. Barstow

William S. Barstow, retired public utility executive and financier, whose death was announced in ELECTRICAL WORLD, January 2, 1943, page 17, was born in Brooklyn, N. Y., in 1866. About the time he was graduated from Columbia College in 1887 he became interested in electricity. Taking a position as apprentice with the Edison Machine Works in Schenectady, N. Y., predecessor of the present General



Blank & Stoller, Inc.

Electric Co., he engaged in testing and supervising the installation of plants in New York, New Jersey and other localities. It was in this way that he became acquainted with Thomas A. Edison, forming a friendship that continued until Mr. Edison's death. Mr. Barstow became associated with the Edison Electric Illuminating Co. of Brooklyn in 1889, serving successively as assistant superintendent, superintendent, chief engineer and was occupying the position of general manager when he resigned in 1901 to become a consulting engineer. While general manager of the Brooklyn company he was very active in the engineering field, devising apparatus and methods for meeting the demands of the rapidly growing central station systems.

In 1906 he formed W. S. Barstow & Co., Inc., and became its president and a director. In 1912 he organized the General Gas & Electric Corp., a utility holding company, which, under the management of W. S. Barstow & Co., Inc., developed and managed a large group of Eastern utilities. He remained as president of the Barstow organization and of General Gas & Electric until 1929.

Mr. Barstow was a founder of the Edison Pioneers and it was as president of that association that he arranged with Henry Ford for the transfer to the Dearborn Institute at Dear-

born, Mich., of the experimental exhibits from the Menlo Park laboratories. On the site of the original laboratory, Mr. Barstow erected a memorial steel tower. He served for many years as secretary, then treasurer and as a member of the executive committee of the Association of Edison Illuminating Companies.

•

Nicholas Stahl

Nicholas Stahl, chief engineer of the Pennsylvania Power & Light Co., Allentown, since 1928, died on January 1 at the New Haven (Conn.) General Hospital at the age of 66. Mr. Stahl had been identified with the electrical industry for 35 years. He was a fellow of the American Institute of Electrical Engineers and some years ago was active in the affairs of the old National Electric Light Association.

•

▶ JOHN C. DAVENPORT, 61, head of the contracts division of the Allis-Chalmers Manufacturing Co., died at St. Joseph's Hospital, Milwaukee, December 19, after a short illness. Mr. Davenport joined the Allis-Chalmers Co. at Norwood, Ohio, in 1904 after having been graduated from Harvard University with bachelor and master of arts degrees. He had designed electrical machinery, including some of the first electric starters for automobiles and large power transformers. He was a life member of the American Institute of Electrical Engineers and a member of the Milwaukee Engineers Society.

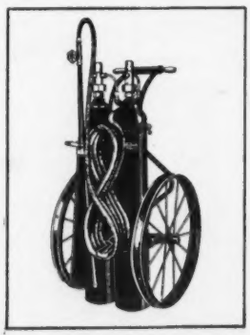
▶ DR. EARL A. WHITE, formerly national director of the Committee on the Relation of Electricity to Agriculture, died at his home in Evanston, Ill., on December 8. He was 58 years old. Dr. White was graduated from the University of Illinois in 1908 with a B.S. degree, subsequently receiving the degree of M.S. from the University of Wisconsin and Ph.D. from Cornell University in 1917. He was on the faculty of the University of Illinois, College of Agriculture, intermittently from 1908 to 1918, later becoming associated with the Caterpillar Tractor Co., Peoria, Ill. For a time after leaving Peoria he was associate editor of *Farm Implement News*, Chicago, In 1923 when the Committee on the Relation of Electricity to Agriculture was formed, Dr. White was named national director, the position he retained until the organization was discontinued on October 1, 1939. Dr. White was a past-president and a fellow of the American Society of Agricultural Engineers.

STOP FIRE IN ITS TRACKS—
AVOID DAMAGE AND SHUT DOWNS

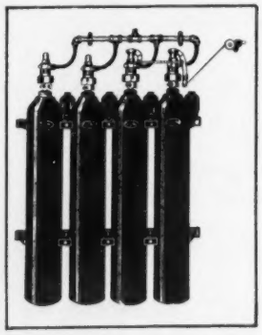
C-O-TWO carbon dioxide equipment especially engineered for generators, transformer vaults and oil storage spaces offers industry the fastest non-damaging non-conducting fire extinguishing method. Instantly smothering all oxygen with a sub-zero blast of C-O-TWO gas, fire is stopped in its tracks without injury to machinery or materials.

If you have danger spots in your plant where flammable liquids are stored or are used in cooking kettles, mixers, process rooms, dip tanks, spray booths or drying ovens, C-O-TWO fire extinguishing equipment will give you modern fire protection.

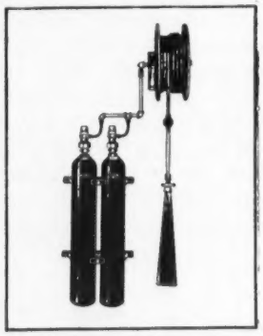
IT'S SAFER because IT'S FASTER



QUICK AS THE WIND
With C-O-TWO hand and wheeled type portables, carbon dioxide is directed at the base of the fire. It's out—without damage—in seconds.



INSTANT ACTION
Permanently installed automatic or manual system may be engineered to protect one or more spaces from the one C-O-TWO installation.



SMOTHERS FIRE
Fixed hose reel type with 25 feet of fast uncoiling, non-kinking hose, will put out fires in electrical machinery, dip-tanks or storage vaults.

C-O-TWO is a registered trademark. To be safe, specify C-O-TWO and this company's name

C-O-TWO FIRE EQUIPMENT CO. C-O-TWO

NEWARK, NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

MANUFACTURING-MARKETS

P. D. Reed Resigns from G.E. Positions

Having been requested by both Ambassador John G. Winant and W. Averill Harriman to continue his work in London as Deputy Chief of the Harriman Mission, Philip D. Reed, chairman of the board of the General Electric Co., announced on January 2 that he had resigned all of his company posts. Mr. Reed arrived from London last week and will shortly return to England to resume his duties, which he took up in July, 1942, having been granted a leave of absence to the end of the year by his company.

"In view of the indefinite duration of this government work overseas and in view also of the return to active service of Owen D. Young as acting chairman of General Electric, I felt that I should relinquish my posts as director, chairman of the board and chairman of the executive committee of the company. I have simultaneously resigned directorships in subsidiary companies," Mr. Reed stated.

The work of the Harriman Mission in England covers many fields of war activity. Mr. Reed will spend two or three weeks in Washington consulting with various war agency officials before returning to London.

•

Stop Production of Lamps, Shades

WPB has halted production of portable electric lamps and shades containing critical material, effective immediately. Restrictions apply to all types, including floor, table and bed lamps.

Production of wire-frame shades was stopped on January 1. Until that time wire frames for shades made of phenolic plastics, iron or steel which already were in manufacturers' inventories could be used. Lamps and shades produced for the Army, Navy, Maritime Commission and War Shipping Administration are exempt, but certain restrictions are imposed on use of critical materials for filling such orders.

•

Assigned Broader Field

Crouse-Hinds Co. has assigned to Horace L. White, for some years Pacific Coast manager, the additional responsibilities of manager of the entire central district. He will commute between Chicago and Los Angeles.

Westinghouse Employees Receive WPB Awards

Sixteen employees of the Westinghouse Lamp Division, Bloomfield, N. J., were recently cited for outstanding achievement and given War Production Board awards for their ideas which have increased output and saved critical materials in the manufacture of war equipment. Awards of individual production merit were presented to 13 men and three women at a Victory luncheon sponsored by the Joint Committee of Labor and Management.

Heading the list of winners was Oscar A. Henn of Roseland, N. J., who, in addition to his WPB merit award,

SERVICE FLAG DEDICATED—General Electric and Army officials participate in the dedication of a service flag in honor of 17,354 employees of the company at the ceremony held at the Schenectady Works. Left to right: Wendell M. Nelson, assistant to the works manager; E. O. Shreve, G.E. vice-president; Brig.-Gen. Ames T. Brown, head of the state selective service system; Major-Gen. Bernard W. Kearney, Congressman-elect from the Schenectady district; W. W. Trench, secretary of the company and chairman of the county war savings committee. During the ceremony the presentation of the U. S. Treasury Department's "Minute Man" flag for the purchase of war bonds was made by Major-General Kearney

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

WESCO aid a "lifesaver" to tire production

Kept Plant Up To Building Schedule; Prevented Shutdown and Product Loss

An Eastern chemical plant produces a critical substance which is a vital part of the Army's famous combat tires. Started without a priority by Government order, this plant, during its erection, was supplied for a year with all electrical requirements by the local Wesco House. Intricate planning and adroit use of non-priority substitutes were required.

Wesco's "know-how" enabled the chemical plant to tie in with the main power plant and begin partial operation 3 months earlier than expected. The customer wrote—"This tie-in material was a lifesaver and greatly helped us continue our construction work." On another occasion Wesco cooperation avoided a major production shutdown.

When the difficult non-priority period was over the customer wrote—"We have expressed our appreciation by telephone several times but wish to confirm this in writing. We thank you for your splendid cooperation." The Wesco service that merits such a letter is now devoted to winning the war. In days of peace that service will be again at the command of industry and business.

WESCO SPEEDS PRODUCTION

* War plant manufacturing basic ingredient of TNT got needed equipment from Wesco in 2 days. Manufacturers promised delivery in 8 to 15 weeks.
* Airfield was saved 81 days' delay on delivery of 68 electrical items. Fastest complete delivery by manufacturers was 12 weeks. Wesco required only 3 days.

WESCO SERVES BUSINESS

* By assembling all parts of an order in one shipment.
* By furnishing informative and technical data.
* By knowing local and national codes and rulings.

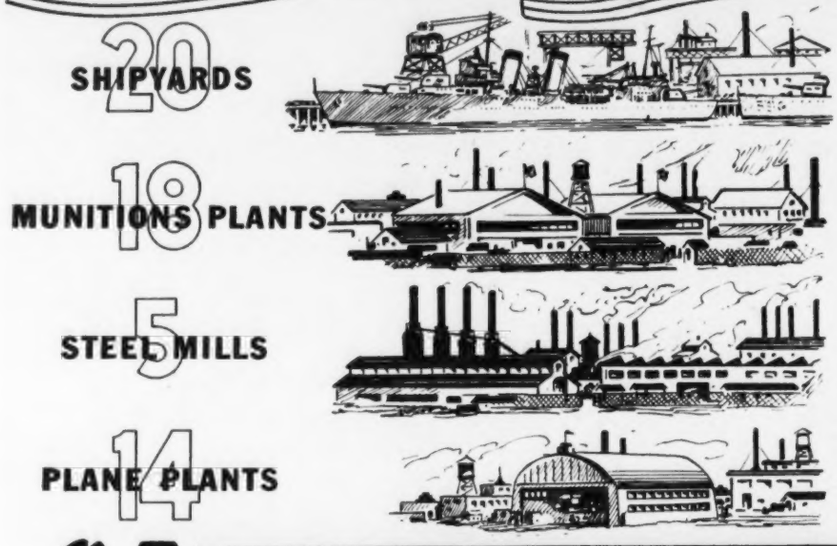
Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

O.Z. helps carry the load with

SOLDERLESS CONNECTORS AND CONDUIT FITTINGS



O.Z. ELECTRICAL MFG. CO.

262 BOND STREET · BROOKLYN, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

3460

How to design, install, and service fluorescent-lighting systems

Just Out!

FLUORESCENT LIGHTING MANUAL

By CHARLES L. AMICK
Nela Park Engineering Dept.,
General Electric Company

312 pages, 6x9, 217 illustrations, many tables. $3.00

CHAPTERS

1. The Fluorescent Lamp
2. Auxiliary Equipment
3. Operating Characteristics
4. Installation Hints
5. Service Suggestions
6. Luminaire Selection
7. Fluorescent-lighting Design
8. Color Quality
9. Fluorescent Applications
10. Lighting Economics

Make sure you get the extra profits promised by the growing popularity of fluorescent lighting. Here is a practical manual covering the subject in all its aspects, presented so that anyone can understand it, with or without much electrical training. Gives the most authoritative information available on construction and performance of all types of fluorescent lamps, principles and methods of calculating illuminating requirements and designing luminaires and installations, pointers and methods of installing and maintaining flourescent lamps and of locating and remedying their troubles. Includes working data, comparison of cost factors of fluorescent and incandescent lighting, etc.—everything to aid in the designing, selling, installing, and servicing of efficient and satisfactory fluorescent-lighting systems.

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., 330 W. 42nd St., N. Y.

Send me Amick—Fluorescent Lighting Manual for 10 days' examination on approval. In 10 days I will send $3.00 plus few cents postage or return book postpaid. (We pay postage if you remit with order.)

Name .....

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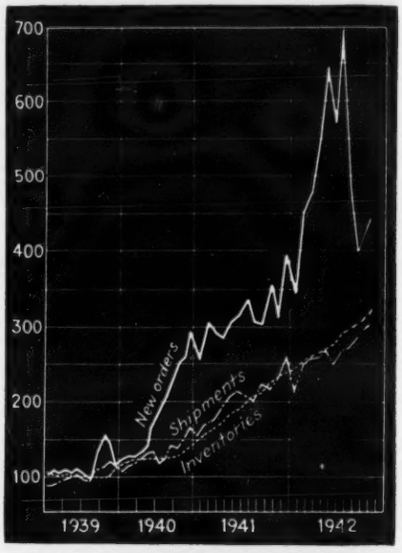
Company .....W. 1-9-43

received a $255 check from Westinghouse for his outstanding suggestion. By designing a new fixture to hold electronic tubes in position during the sealing process, Mr. Henn has reduced the time of the operation from one hour to 48 minutes for each tube.

•

Electric Machinery Indices Advance

A broad advance in new orders for both durable and non-durable goods was registered during the month of October, according to the survey made by the Bureau of Foreign and Domestic Commerce. New business continued to flow in exceptionally large volumes to producers of durable goods. The index of value of new orders received by electrical machinery manufacturers ad-



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

vanced to 448 from 411 in September, comparing with 359 in October, 1941.

Record shipments are now generally prevalent throughout industry. The electrical machinery shipments index rose to 314 in October from 286 in September, comparing with 218 in October, 1941.

Electrical machinery inventories index also advanced to 321.5 in October from 307.1 in September. It stood at 225.5 in October, 1941.

•

Omits Dividend Action

In view of the fact that the renegotiation of contracts covering business done with the United States Government in 1942 has not been concluded, the board of directors of Western Electric Co. at a special meeting decided to declare no further dividend for 1942.

Field Reports on Business

Orders for replacement of electrical supplies, particularly for small motors and control apparatus, are being allocated at a good rate. Conversion from oil to coal burning has resulted in the installation of some electrical apparatus. The new year begins with practically no dealer appliance stocks.

NEW YORK

WPB's inventory limitation order L-219, hanging fire these many weeks, has finally become a reality. Distributors having annual sales of more than $200,000 and inventories in excess of $50,000 will henceforth have to keep their inventories at the same level, in relation to the prospective sales of each quarter, as prevailed in the base period of 1939-1941. Three major reasons were outlined by the war agency for the order: Larger companies have been accumulating large inventories of consumer goods, with the result that smaller outlets, not as financially strong, were handicapped; curtailed production of consumer goods created a distribution problem (towns and villages without big outlets were running out of goods); new communities have sprung up around war plants lacking regular distribution facilities.

The order applies to an estimated 25,000 retailers, 8,000 wholesalers and 12,000 manufacturers. Where inventories exceed the allowed ratio, purchases will be limited until they are brought into line. Monthly reports will be required from such distributors to assure compliance with the order. In the event that smaller outlets resort to building up stocks, inasmuch as the order does not apply to them directly, WPB will probably make some further changes in the order to cope with the situation. At present it was emphasized that this is a flexible order and, if it is necessary in the public interest, the exemption limits may be lowered. Donald M. Nelson characterized the measure as "an experiment in self-government for the smaller stores."

PACIFIC COAST

Wholesalers report considerably more concentrated stocks than for last year, but with parallel items in such lines as steel, plastic and porcelain boxes and covers. Inventories are down and have been more quickly taken. The new year begins with practically no dealer appliance stocks and the public is consequently taking considerably more interest in "appliance durationizing" campaigns.

War housing is the major construction item, and will grow even greater, because the present ration of "seekers" to "finders" of living quarters in certain areas of the new industrial west is in the ratio of five to one. Scattered encampments and plants in the interior states have also been allotted funds. There has been considerable recent shifting of central purchasing for the services, which, so far, has favored the West.

Recent orders include six 15-kv. Westinghouse circuit breakers, costing $60,030, for Mead station of Bonneville system; $17,000 of G.E. voltmeters, ammeters and panel switches; capstan and windlass motors and controls, costing $400,000, for Kaiser ships under construction; $20,000 of crane motors for Pearl Harbor, and four 500-hp. motors and $40,000 switchgear equipment for Pacific overseas shipment. City of Los Angeles is in the market for 75 400-amp. disconnect switches.

Industrial developments cover additional buildings for Provo, Utah, steel mill, and DFC allotments of $200,000 for coast carbon plant in Washington, $1,800,000 for Boeing aircraft factory and $300,000 for a turbine-generator plant in California, all these amounts being about 10 percent of the respective commitments to date.

NEW ENGLAND

During the past week activity in the electrical market touched a low level. Interest in heavy electrical machinery which may be booked during the coming year is occupying some attention. Orders for replacements of electrical supplies, particularly along the line of small motors and control apparatus with total outlays less than $1,000 that can be marked "emergency" under high priority ratings, are being allocated at a fairly good rate, with prospects that this phase of small lot orders for equipment may become quite active in 1943. Pressure by state and national government authorities to bring about conversion in heating large buildings from fuel oil to coal burning has resulted in some changes in which electrically operated and controlled stoking apparatus has been installed. Manufacturers have submitted bids for ventilating and air-conditioning equipment, communication apparatus and supplies, and radio accessories. During the holiday season radio sales took on one of the leading roles in activity in electrical fields. Interest in larger units is pronounced.

Additions to temporary frame buildings in army training fields provide the main outlet for wiring supplies for light and power. The supply of reconditioned electrical power equipment and control apparatus is now very nearly depleted as a result of the heavy demand for emergency installations to take care of the step-up in production.

Retail merchandising during the holidays was strong. Among the items attracting most attention were domestic electrical appliances, unfortunately few in number.

CHICAGO

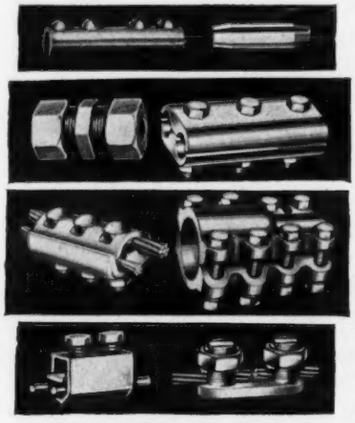
The year just ended found industrial activities in this area at an all-time record level. The amount invested in new and expanded manufacturing facilities during 1942 was well above that of any other single year. Plants are still being converted to the production of war materials and a sizeable number are receiving war orders for the first time as each week passes.

During the last week of the year 90 companies received 200 war orders. New construction has fallen off and will decline further. Considerable plant expansion is still being done, but not on the huge scale of last year.

As a result the trend of electrical equipment orders is slowly decreasing, and as compared with last year the volume will not be so favorable. Production and maintenance items, however, are increasing in demand, as are the repair and service functions. Except for a comparatively few instances electric appliance stocks are entirely depleted.

For any good Straight or Parallel Connector, *see the* **COMPLETE** *line*

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a *complete* line of Bolted Straight Connectors and Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
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STRAND

Combines All 4

1—HIGH STRENGTH
2—RUGGEDNESS
3—LONG LIFE
4—ECONOMY

All the inherent strength and ruggedness that steel alone provides are combined with long life and definite economies in Crapo Galvanized Steel Strand. Each size and grade developes the full tensile strength of the steel in its complete cross-section. The heavy, ductile, tightly-bonded zinc coating—applied by the famous Crapo Galvanizing Process—affords lasting protection against corrosion, extends the life of the strand beyond the normal period for replacement.

Low first cost, workability in the field, consistent, trouble-free performance and low maintenance expense characterize the service history of this time-tested product. There is a size and grade of Crapo Galvanized Steel Strand for every practical need. Consult the distributor of Crapo Galvanized Products near you or write direct for further information!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

LETTERS TO THE EDITOR

"Equivalent" for "Substitute"

To the Editor of ELECTRICAL WORLD:

In reviewing the array of suggestions for a good substitute for "substitute" I was surprised at not finding the most logical and simple term, "equivalent." It seems to me that "equivalent" would best describe the object as being of a quality equal to the one replaced and thus would imply no inferiority.

P. NISSENSON,
Northern States Power Co.,
St. Paul, Minn.

•

Weather Bureau Eager to Assist on Forecasts

To the Editor of ELECTRICAL WORLD:

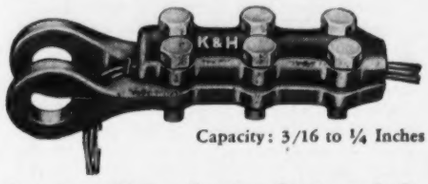
I have just read the editorial "More Weather News Can Help Utility War Effort," in the December 12 issue of ELECTRICAL WORLD, and would like to thank you for the forthrightness and practical good sense of that statement. At the same time, please let me add my assurance of the Weather Bureau's desire at all times to serve as fully as possible in the eminently praiseworthy efforts and accomplishments of the utilities to meet the additional demands that have been placed upon them as a result of the war. There is every reason that the Weather Bureau's facilities should be available to promote those accomplishments.

I believe that part of the present difficulty arises from the inescapable restrictions placed upon the distribution of weather information for security reasons. For example, as implied in your article, teletype installations have been specifically restricted to establishments under some form of continuous military control. I think it unlikely that this restriction will be lifted while hostilities continue, but I should like to invite all utilities to make direct contact with our offices throughout the United States, including those at airports, to see whether alternative arrangements for direct communication between our officers and those of the companies concerned cannot be set up in order to provide specialized and usable interpretations of the weather information previously available to the utilities by way of teletype drops. I suggest this not merely as an idea but as a recommendation based upon a year's experience,

A Line Wire is no better than its Connections

DEAD END CLAMPS
for Stranded Copper Line

Comprised of Wires of Different Hardness



Capacity: 3/16 to ¼ Inches

New Lead Sleeve Feature Protects Soft Copper Strands . . . Easily Attached

K&H Dead End Clamps for Stranded Copper Line comprised of wires of different hardness, prevent abuse to the soft strands by means of a special lead sleeve fitted into the receiving portion of the clamp which protects stranding from contact with each other, as well as from direct contact with the gripping portion of the clamp itself. Under strain test, cables have been stretched to the breaking point without marring the individual strands held in clamp.

★ WRITE FOR BULLETIN 12-A ★

K&H KRUEGER & HUDEPOHL
Solderless Terminal Lugs and Connectors
S. E. VINE AT THIRD • CINCINNATI, OHIO

EXTRUDED VINYLITE TUBING

Natvar V.I.T. #200:
The flexibility is excellent through a wide range of temperatures. A 0.016" wall tubing can be bent back on itself without cracking when tested as low as minus 50° F.
The dielectric strength averages 1100 volts per mil.

Natvar V.I.T. #201:
Will not lose its form up to 240° F. Resistant to pitch at 350° F. poured over the tubing to a depth of ½ inch.
The dielectric strength averages 800 volts per mil.

Natvar V.I.T. #202:
Excellent flexibility down to minus 70° F.
The dielectric strength averages 500 volts per mil.

SUPPLIED ONLY FOR DEFENSE ORDERS
Write for samples and information!

THE NATIONAL VARNISHED PRODUCTS CORP.
211 Randolph Avenue, Woodbridge, New Jersey

Help Wanted?
here it is!

Giving the workers you have more and better equipment to work with is like hiring more help. Now, more than ever, maintenance crews need Simplex Pole Pulling, Moving and Straightening Jacks. They eliminate digging. One man and the No. 329 Jack shown can lift or straighten the average loaded pole or can pull poles or butts. Can be used with grab chain or snubbing cable.

See other models and other labor-servers in Bulletin U-42.

Templeton, Kenly & Co.
Chicago, Ill.
Better, Safer Jacks Since 1899

Simplex
LEVER - SCREW - HYDRAULIC
Jacks

Know Electricity as Experts Know It!

and Get an Expert's Pay!

What about your future? Who is safe today? Surely not the man who is contented to stand still! Know your job thoroughly—prepare yourself for jobs ahead. To do just this thousands of men have used

The Croft Library of Practical Electricity

The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hard-headed facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers. Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

No money down—easy payments

Fill in and mail the coupon attached and we will send you the entire set of six volumes for ten days' Examination. We take all the risk—you assume no obligation. If you decide to keep the books send $3.00 in ten days and the balance at the rate of $5.00 a month. Send the coupon NOW and see the books for yourself.

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Send me for ten days' examination on approval the Croft Library of Practical Electricity, 7 vols. If satisfactory I will send you $5.00 in 10 days and $3.00 monthly until the price of $18.00 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

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City and State .....
Position .....
Name of Company ..... W. 1-9-43

in which in a number of instances the plan has worked. In doing so, please let me reaffirm the Weather Bureau's wish to provide the maximum possible assistance in the splendid work the American utilities are doing.

F. W. REICHELDERFER,
Chief, Weather Bureau,
U. S. Department of Commerce,
Washington, D. C.

BOOKS RECEIVED

Frequency Modulation. By August Hund. McGraw-Hill Book Company, New York. 375 pages, illustrated. Price $4.

Clarifies differences between phase, amplitude-, and frequency-modulation systems as to phenomena, technique and application. Uses Bessel functions but sets up applications so they can be made intelligently without recourse to derivations. Auxiliary and segregating equipments, FM transmitters and receivers, antennas are accorded independent chapters.

Alternating-Current Machines, 2nd Edition. By A. F. Puchstein and T. C. Lloyd. John Wiley & Sons, Inc., New York. 655 pages, illustrated. Price $5.50.

Lucid, terse and concise, this text is more comprehensive and versatile than is covered in most college courses. Alternator and synchronous motor treatment revised to conform to new procedures for reactance and regulation determination. Also treats transformers, induction regulators, motors (induction, condenser, series, repulsion), parallel operations, converters, rectifiers.

The Electrical Fundamentals of Communication, 1st Edition. By Arthur L. Albert. McGraw-Hill Book Company, New York. 554 pages, illustrated. Price $3.50.

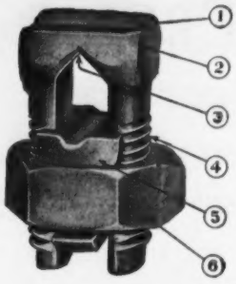
Distinctly an approach treatment which selects and warps familiar fundamentals toward the electronic emphasis which differentiates communication as a field of practice. D.c. and a.c., magnetics, capacitances, instruments and vectors precede networks, bridges, wave propagation, tubes and electroacoustics. A beginners' text from Oregon State.

Plastics for Industrial Use. By John Sasso. McGraw-Hill Book Company, New York. 229 pages, illustrated. Price $2.50.

Industrial application information on the more important plastic materials. Emphasis is on comparative properties, criteria of selection for specific uses, and proper design. Early chapters give such basic information as physical properties (weight, tensile strength, compressive strength, impact strength, electrical and thermal properties and moisture reactance), molding methods, engineering and finishing. Later chapters are devoted to specific plastics.

American Diesel Engines—Their Operation and Repair. By E. F. Goad. Harper & Brothers, New York. 313 pages, illustrated. Price $2.75.

Practical treatment for vocational and extension groups. Simplifies the thermodynamic basis; discusses fuel supply and ignition systems (with the requisite accessories), along with engine details; starting, operation, testing, maintenance are tersely treated in respective chapters.



Nutype Matthews
Conductor Connectors

Reasons
WHY THEY ARE BETTER:

(1). Broad, strong head, with size plainly marked. Sides of head have flat surface so wrench or pliers can grip tightly.

(2). 100% Pure Copper, Cold forged bolt of ample strength for all purposes. High copper content prevents corrosion and season cracking. All edges are rounded.

(3). Modified "V" shaped groove, holds wires in three point contact and prevents rocking or looseness.

(4). 85% plus, full thread, die stamped, insures full engagement in nut, hence high strength connectors. No sharp edges.

(5). "V" groove clamping jaw of cold forged, 100% pure copper. Flanged sides give greater bearing surface on nut, hence greater strength.

(6). 97% copper content, hard metal nut—strong as steel. Full thread engagement with bolt.

(7). Made in 9 sizes—6 sizes of cold forged copper as illustrated and 4 sizes of machined high copper content alloy.

Send for bulletin and free samples and convince yourself of their superiority.

With Nut Retainer

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

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ENGINEERING SERVICES
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Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.
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36 State Street, Albany, N. Y.

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Plant Surveys—Reports
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BROADWAY MAINTENANCE CORPORATION
LIGHT AND POWER DIVISION
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FORD, BACON & DAVIS, Inc.
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VALUATIONS • REPORTS
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THE ONE-STEP METHOD
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Engineers
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DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES
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HUGH L. COOPER & CO. INC.
General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
30 Rockefeller Plaza New York

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(Electric & Telephone Line Construction Co.)
Wood pole transmission lines
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SPOONER & MERRILL, INC.
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Design—Supervision of Construction
Reports—Examinations—Valuations
20 North Wacker Drive, Chicago, Illinois

DAY & ZIMMERMANN, INC.
ENGINEERS
Design - Construction - Management
Investigations and Reports
NEW YORK PHILADELPHIA Packard Building CHICAGO

HOOSIER ENGINEERING COMPANY
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46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
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STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
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BOSTON • NEW YORK • CHICAGO • HOUSTON
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Electrical Testing Laboratories Inc.
WAR WORK TESTS
ELECTRICAL — MECHANICAL — PHYSICAL — CHEMICAL — for compliance with Government Specifications.
Inspection—Analysis—Research—Certification
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WILLIAM S. LEFFLER
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HIGH GRADE
HARD PORCELAIN
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Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY

G.C.A.

Lamp Replacers
Lamp Base
Removers
Cartridge Fuse
Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 26 years

THE G. C. A.
Manufacturing Co.
Pittsfield, Mass.

TRICO COLORTOP FUSES
THE COLOR TELLS THE SIZE

SAFETY FIRST

- NO GLASS—No cuts
- NO METAL—No shocks
- NO BURNS—hot flashes can't vent thru sealed top.
- UNDERWRITERS' LABEL on each fuse.

That's why leading Utilities demand COLORTOPS . . . the Safety First fuse.

Write for sample

TRICO FUSE MFG. CO.
MILWAUKEE WISCONSIN

THE ELECTRICAL BUYERS REFERENCE is packed full of buying and specifying information, all in one handy, ever-ready volume.

Active electrical men say it's the most valuable volume in their offices. Use it yourself . . . it's *your first source of information.*

• ELECTRICAL •
BUYERS REFERENCE
330 West 42nd Street, N. Y. City

Sales Opportunities

MINNESOTA—Interstate Power Co., Dubuque, Iowa, plans extension in transmission line to connect with line to be constructed by Fairmont Water and Light Commission. Cost estimated close to $85,000. Work is scheduled to begin soon.

WISCONSIN—J. I. Case Co., Racine, manufacturer of agricultural machinery and implements, will carry out expansion in plants in Wisconsin, Iowa and Illinois for production for government, including new buildings and installation of machinery, electrical equipment and other facilities for large increase in present capacity. Cost over $2,500,000. Financing by Defense Plant Corp. Work will be carried out at early date.

WASHINGTON—Department of City Lighting, Seattle, receives bids until January 21 for construction of second section of Ross power dam expansion, including equipment and materials. Latter will comprise about 40,000 lin. ft. of cable, stranded and other electrical wire; hoisting cables, chains and hoists; regulating and other valves, welded steel pipe, etc. Cost estimated at $10,165,000. Dam will be used for increased hydroelectric power for city, with bids for station and other branches of development to be asked at later date. Project has a AA-2X rating.

OKLAHOMA—Navy Department, Washington, D. C., has authorized new naval air base, comprising group of hangars, shops, warehouses and other industrial buildings. Electric equipment will be installed, with power substation and distribution system for airfield, industrial and residential service. Entire project will cost close to $3,000,000 and will be carried out under direction of Bureau of Yards and Docks, Washington.

CONNECTICUT—Hartford Electric Light Co., Hartford, has secured permit for construction of coal-handling plant at generating station, including unloading tower, two transfer houses, hoppers, conveyors and other equipment. Cost estimated close to $265,000. Work will be carried out at once. Stone & Webster Engineering Corp., Boston, Mass., is engineer.

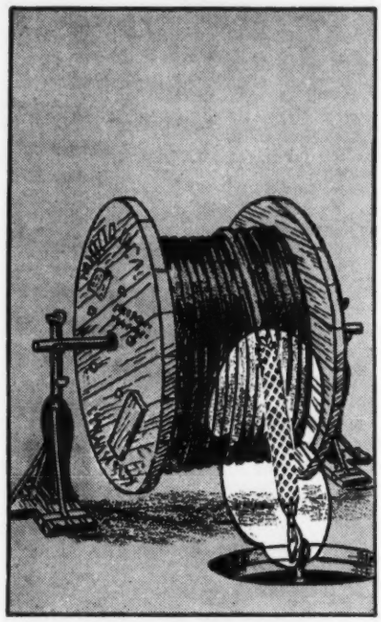
TEXAS—North American Aviation of Texas, Inc., Dallas, affiliated with North American Aviation, Inc., Inglewood, Calif., plans extension in plant for production of military aircraft, including new buildings and installation of machinery, electrical equipment and other facilities for large increased capacity. Cost over $1,250,000, with financing by Defense Plant Corp.

ARKANSAS—Civil Aeronautics Administration, Washington, D. C., plans new airport, tract of land being secured, to include complete lighting installation, underground conduits, control station and other facilities. Appropriation is being arranged and project will be carried out soon.

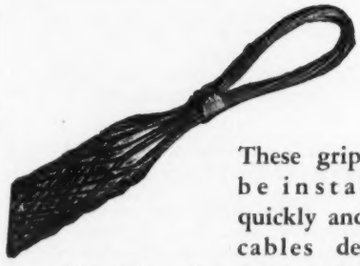
WASHINGTON—U. S. Engineer Office, Textile Tower Building, Seattle, is asking bids (no closing date stated) for installation of an electrical distribution system at a military site.

OREGON—Columbia Steel Casting Co., Johnson and N.W. Tenth Sts., Portland, plans extensions in plant for production for government, including new buildings and installation of machinery, electrical equipment and other facilities for large

SPEED
CONSTRUCTION
and EXPANSION
of PLANT FACILITIES



RELIABLE CABLE GRIPS
For Pulling in
Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES

increased output. Cost estimated over $700,000. Financing by Defense Plant Corp. Work is scheduled to be done soon.

IOWA—Central States Electric Co., Cedar Rapids, plans expansion in generating station, including installation of equipment for increased capacity. Proposed to carry out work at early date.

MISSOURI—City Council, Moberly, plans early installation of electrical equipment at new municipal airport now in course of construction. Mid-West Engineering Co., Moberly, is consulting engineer.

RHODE ISLAND—Rheem Mfg. Co., Providence, plans rebuilding of fabricating shop at local shipyard at Field Point, recently destroyed by fire, with loss reported close to $200,000. Installation will include machinery, electrical equipment and other facilities. Main offices of company are at 30 Rockefeller Plaza, New York, N. Y.

NEW YORK—United States Radiator Corp., National Bank Building, Detroit, Mich., plans expansion in plant, including additional buildings and installation of machinery, electrical equipment and other facilities for large increased capacity. Work will be carried out soon. Cost estimated in excess of $800,000. Financing by Defense Plant Corp.

IOWA—Civil Aeronautics Administration, Washington, D. C., has plans maturing for expansion and improvements in airport, including lighting installation, additional control station equipment and other facilities. Bids are scheduled to be asked in February. The cost is estimated at approximately $650,000.

MICHIGAN—Palmer-Bee Co., Westminster St. and Grand Trunk R.R., Detroit, manufacturer of elevating, conveying and allied machinery, plans expansion in plant for production of military materials, including additional buildings and installation of machinery, electrical equipment and other facilities for increased capacity. Project will be carried out soon and is estimated to cost approximately $700,000. Financing by Defense Plant Corp.

INDIANA—Richmond Airport Commission, Richmond, Windsor B. Harris, chairman, has plans under way for new municipal airport on tract of about 560 acres, including complete electric lighting installation, underground conduits, control station and other facilities. Cost about $900,000, with financing and supervision by the Civil Aeronautics Administration, Washington, D. C. It is proposed to carry out this work in 1943.

CALIFORNIA—California Rock Salt Co., 2436 Hunter St., Los Angeles, will carry out expansion in a plant, including new buildings and installation of machinery, power equipment and other facilities for large increased output. Cost estimated over $300,000. Financing by Defense Plant Corp.

•

Eureka Reports Net

Eureka Vacuum Cleaner Co. reports, for the quarter ended October 31, subject to audit and year-end adjustments, a net profit of $90,222, after depreciation, interest, federal income and excess profits taxes, etc., equal to 45 cents a share on 201,919 shares of capital stock. This compares with a net loss of $8,818 for the quarter ended October 31, 1941.

SEARCHLIGHT SECTION

(Classified Advertising)

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10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
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NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

POSITION VACANT

TROUBLE SHOOTERS, Armature and Stator Winders, are offered permanent position with one of New England's largest and most successful independent repair shops engaged in defense work. Only men of good character, long experience, and exceptional ability capable of rapid development to positions of responsibility will be considered. Our employees know of this advertisement. All applications will be treated as confidential. P-333, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 33 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVE AND TECHNICAL MEN. Qualified candidates desiring $2,500 to $20,000 position may contact employers through our confidential services, established 27 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITION WANTED

POSITION as superintendent of municipal utilities, twenty years experience with steam and diesel generating equipment and distribution systems. PW-331, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

EXECUTIVE Position Wanted — Estimator — Accountant. Twenty years' experience: purchasing materials, supplies; financial; statistical; unit, production cost; governmental procedure. Speaks, reads, writes, German, Spanish, some Japanese. Minimum salary $6,000. Now employed executive position; can get release. 3A; travel anywhere. PW-334, Electrical World, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

MANUFACTURERS' REPRESENTATIVES (Four Engineering Salesmen) selling transformers and safety switches in Chicago and mid-western states, desire kindred lines. Own Warehouse facilities. RA-93, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

MISCELLANEOUS

WE RECLAIM SOLVENTS: Don't discard spent thinner degreaser residues, etc. Send a sample for quotation. Dytex Chemical Co 267, Plain St., Providence, R. I.

WANTED

Instrument expert by leading aircraft engine manufacturer in East. Engineering training and calibration experience required although not necessarily in aircraft engines. Must be able to devise new and more nearly accurate methods of temperature and pressure measurement and to improve existing methods. No applications sought from persons employed in war production.

P-88, Electrical World
330 West 42nd St., New York City

PRIME **LOANS** TO
CORPORATIONS and INDIVIDUALS
Unsecured or Collateralized
LARGE Sums—LOW annual rates
COLLATERAL DISCOUNT CORP.
Graybar Bldg.—New York City

FOR SALE

FOR IMMEDIATE SALE
5-200 KVA TRANSFORMERS
G.E., type H, 60 cy., single phase
Primary 2300/2185/2070 volts
Secondary 230/460
F. S. 333 Electrical World
330 West 42nd St., New York City

TRANSFORMERS FOR SALE

2—Westinghouse Electric 400 kva. 22,000 primary, 440 secondary, single phase, 60 cycle, Scott taps.
2—G.E. 500 kva, 33,000/66,000 primary, 2300/4000Y secondary, 3 phase, 60 cycle.
1—900 kva, Pgh. 6900 or 2300 primary, and secondary (new windings), 3 phase, 60 cycle.
3—300 kva, Pgh. 22,000 primary, 120/320 secondary, single phase, 60 cycle furnace transformers.
3—G.E. & W.H. 500 kva rotary transformers, 23,000 primary, 485 secondary, 3 phase, 60 cycle.

ELECTRIC POWER CONSTRUCTION, INC.
569 S. Main St. Akron, Ohio

WANTED
For Navy Defense Work, three (3) 1250 KVA, 38000/4160/2300 Volt, used Transformers.
THE ARUNDEL CORP.
CONSOLIDATED ENGR. CO., INC.
HARDAWAY CONTRACTING CO.
600 Standard Oil Building
Baltimore, Maryland

Watch—
the *Searchlight Section*
for
Equipment Opportunities

"Hemphill" Equipment is Ready for You

MOTOR GENERATOR SETS

2—200 KW, 125 volt, Westinghouse, sq. cg.
1—100 KW, 125 volt, G.E., sq. cg.
1—50 KW, 250 volt, General Electric, sq. cg.
1—20 KW, 600 volt, G.E. sq. cg.

D. C. GENERATORS

1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—75 KW, 675 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 600 RPM, 440 volt, Lincoln, slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E. slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volts, G.E., syn.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E. Syn.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 600 RPM, 550 Volt, General Electric, Sq. Cg.
1—200 HP, 600 RPM, 440 Volt, Crocker Wheeler, Slip Ring.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 HP, 1800 RPM, 440 volt, West. Sq. Cg.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
1—150 HP, 1200 RPM, 440 volt, G.E. Sq. Cg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G. E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.

MOTORS—D. C. 230 VOLTS

1—250 HP, Electro Dynamic, 750 RPM.
1—150 HP, Electro Dynamic, 750 RPM.
1—125 HP, Westinghouse, SK, 600 RPM.
1—100 H.P. G. E. 575 RPM
1—100 H.P., 625 RPM, G.E.
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—50 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 00/1500 RPM, Westinghouse.
1—35 HP, Electro Dynamic, 350/1000 RPM.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 225/900 RPM, Electro Dynamic.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 Volt, Allis Chalmers.

TURBO-GENERATORS

1—600 KW, Terry, dual bleeder.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts
2—200 KVA, General Electric, 4600/2300-230/460 Volt.
1—150 KVA, General Electric, 2200/110/220 Volt.
3—150 KVA, G.E., 33,000-2300/4000 Y.
3—100 KVA, Westinghouse, 13200/250 volts.
1—100 KVA, General Electric, 2200/2200/110 Volt.
1—75 KVA, G.E., 3 phase, 4150-120/208 v.
3—50 KVA, Wagner, 4150-220 volts.
3—50 KVA, G.E., 2200-110/220 volts.
4—37½ KVA, 2200-220/110 v.
2—37½ KVA, 2200/220/440 Volt.
2—25 KVA, General Electric, 2300/4600-230/460 Volt.
3—25 KVA, Westg., air cooled, 440/220/110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
4—10 KVA, G.E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

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We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M — Since 1912 — CINCINNATI, OHIO

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AC-DC—25 and 60 cy.

SPECIALS

1—300 HP. Gen. Elect. Slip-Ring Motor, 3/60/2200 V. 1200 RPM.

1150 HP. G. E. Synchronous Motor 25/3/2200/375.

GENERATOR SETS
FREQUENCY CHANGERS
GENERATORS

SPECIALS

1—100 KW Motor Generator Set, Generator 220 V DC. Motor 3/25/2200 V.

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124 Church St., Buffalo, N. Y.

POWER HOUSE EQUIPMENT

15 Kv. Metal Clad Switchgear
FK-255-C Breakers
5—1200A.—1—2000 A.
500,000 Kva. Capacity

1—14,000 GPM—26' Head Vertical Pump
1—100 HP—2200 V. Motor
1—Starting Compensator

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Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, etc.

Service backed by 38 years' experience

BREW, WOLTMAN & CO.
30 Church St., New York

ROTARY CONVERTERS—3 PH. 60 CY.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200

ROTARY CONVERTERS—3 PH. 25 CY.

3—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M.G. SETS—3 PH. 60 CY.

1—1500	G.E.	720	600	6600
1— 500	Whse.	720	250	2300
1— 500	G.E.	720	600	13200

BELYEA COMPANY, INC.
51 Howell Street, Jersey City, N. J.

FOR SALE

1—100 Kva output Maloney 60 cycle 55 Deg. C. rise 2 phase to 3 phase auto transformer rated 208 volts 3 phase 3 wire high voltage to 240 volts 2 phase 3 wire low voltage, complete with the necessary oil.

VICTOR METAL PRODUCTS CORP'N
196 Diamond Street — Brooklyn, N. Y.

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Ever think what a time saver advertising is? In this issue you have helpful information from dependable manufacturers! Look each page over carefully—you may find the answer to your most pressing problem.

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TYPE ET-20 *Thermal* Circuit Breakers

Do you know how useful TYPE ET-20 is?

FIG. 1

With main feeder distribution circuits heavily loaded as they now are, there is need for high interrupting capacity. Type ET meets this need with

interrupting rating of 25,000 amperes.

Changeovers in industrial operations call for flexibility in the current ratings of circuit protective devices. For this need, the Type ET circuit breakers have

interchangeable trip units

with continuous ratings ranging up to 600 amperes. Trip units are very easily changed.

To meet a variety of requirements, Type ET-20 circuit breakers are available with

undervoltage trip and shunt trip

Provision is made for auxiliary switches with one "a" and one "b" contact and overcurrent bell alarm switches.

Avoidance of needless power interruption was never more important than it is now. Inherent time-delay incorporated in Type ET-20, permits continuous service unaffected by harmless overloads. Tripping mechanisms have true

inverse-time characteristics

—the greater the need for opening the circuit, the more quickly it is accomplished. Heavy overloads and short circuits trip the breaker instantaneously.

Type ET-20 circuit breakers are extremely compact. Over-all case dimensions are 19½ x 9 x 6 inches.

Space is saved.

Design of the Type ET-20 provides maximum ruggedness with minimum material.

Critical materials are saved.

FIG. 2

Type ET-20 circuit breakers, shown in Fig. 2 mounted in a withdrawal type switchboard and in Fig. 3 in an individual steel enclosure, are installed in main feeder distribution circuits, up to 600 volts a-c and 250 volts d-c. They are accurately calibrated at the I-T-E factory. They serve with a very minimum of maintenance.

FIG. 3

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

ARMY NAVY

The Army-Navy "E" for Production Excellence

I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.

•LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION

CAUSES OF TURBINE OIL EMULSIONS AND CORROSION

AND HOW NONPAREIL TURBINE OIL HELPS PREVENT THEM

Turbine oils that do a good job of preventing corrosion usually sludge pretty quickly. And, vice versa, a turbine oil that's relatively sludge-free is much more likely to permit corrosion.

WHAT MAKES OIL AND WATER MIX?

An emulsion, which is a mixture of oil and water, is usually caused by one of two things, or both. No. 1 is dirt in the oil such as dust and other foreign materials which get into the oil during handling and operation. No. 2 is something in the oil itself—unstable hydrocarbons, asphaltenes and organic acids, say the chemists, are the most common. These help make sludge. What is desirable in a turbine oil is good demulsibility—the ability to separate readily from water.

WHAT CAUSES CORROSION?

Turbine oils don't cause corrosion. Corrosion is caused by *water*, if the turbine oil *permits* it. A turbine oil that doesn't wet the metal and stick to it, may let water push it off the metal surface. That's when rust starts. So the thing an oil needs is ability to wet the metal—wet it with oil, that is, and stick to it.

WHICH DO YOU WANT—DEMULSIBILITY, OR CORROSION PROTECTION?

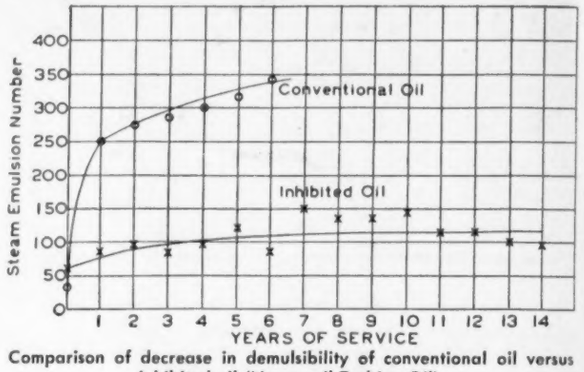
There's nothing hard about making an oil that will stick to metal. Ordinary black oil does a swell job. Paraffine oil with a little lard oil added does an outstanding job of wetting metal and sticking to it. But—and here's the trouble—these oils that stick to metal so well do not separate readily from water. They mix—and sludge starts.

There's been a lot of talk lately about adding a little of the old oil to new oil, to prevent corrosion. The old oil has higher acidity than new oil and is more likely to stick to metal. But with that method you simply gain rust protection at the expense of sludging.

Most oils have been a compromise between good demulsibility and good wetting ability. Refiners have had to make an oil that was highly demulsible, and hope for the best so far as corrosion was concerned; or to make an oil that gave good rust protection, and ask that it be changed or treated when its acidity rose and sludging was threatened.

HERE IS A WAY OUT OF THE DILEMMA

Some years ago, Standard Oil research men found a way out of the dilemma. They made a highly refined oil that separated readily from water. Just to make sure that it wouldn't sludge, they added a patented inhibitor—a chemical which keeps the acidity down.



Comparison of decrease in demulsibility of conventional oil versus inhibited oil (Nonpareil Turbine Oil).

So far, so good. But what about rust? Rust, you remember, occurs because oil lets water push it off the metal. We need an oil that will really wet the metal, and stick to it. This fine, high-grade non-sludging oil alone wouldn't do that as well as some other oils.

So they developed a corrosion inhibitor, which makes this non-sludging white oil wet metal, and stick to it. This inhibitor has been added to Nonpareil Turbine Oil since 1927.

WE GUARANTEE NONPAREIL TURBINE OIL IN WRITING

To men who know turbine oil problems, it seems unbelievable to get a turbine oil that is superior *both* in freedom from sludging and in prevention of corrosion. To assure them that Nonpareil is really something out of the ordinary, we issue a signed guarantee for each installation.

The best way to forecast sludging is by a rise in acidity. So we say, watch the acidity of your oil. (In fact, we watch it for you, by regular sample analysis.) If, says our written guarantee, the neutralization number rises beyond 0.15 mg/KOH gm., when the temperature of the oil from the bearings has been kept below 170° F., we will cheerfully replace the entire batch of oil.

Proof enough, isn't it? But here's more. Right now, 640 turbines are operated on Nonpareil Turbine Oil. Many of them are the second and third turbines in the plant on Nonpareil. Many have been operating 10, 12, 15 years on the *same batch* of Nonpareil, and the rest of them will be operating that long and longer, in a few more years. We guarantee Nonpareil Turbine Oil for the life of the turbine. And that is usually pretty long, especially when it runs on Nonpareil.

Drop us a card, or, if you're in the Middle West, phone the nearest Standard Oil Company (Indiana) office for a turbine oil specialist. If you are technically minded, ask for our Engineering Bulletin No. TN-571 on Turbine Lubrication with Nonpareil Turbine Oil.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA